ANNALS

OF

SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY

LEWIS STEPHEN PILCHER, M.D., LL.D.,

OF NEW YORK.

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ANNALS *of* SURGERY

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BRANCHIOGENIC CARCINOMA

BY FRANK WARNER, M.D.
OF COLUMBUS, OHIO

A STUDY of the embryology of the neck gives a clear and comprehensive idea of the method of the development of branchiogenic fistulæ and cysts upon the one hand, or of branchiogenic carcinomata upon the other. In early fetal life, serial sections made in the region of the developing pharyngeal regions, four arches, or gill bars, are seen upon either side, separated by three grooves of greater or less depth both internally and externally, constituting an infolding of the entoderm and ectoderm into the tissue between, the mesoderm. The membrane between the inner and outer grooves constitutes the plates. Sometimes, the grooves cut on through, then, in the event of a failure of the clefts to close, a fistula will result.

These clefts close normally later in fetal life with the exception of the first, from which the external auditory canal and eustachian tube is formed.

If any one of the other clefts fail to close through its entire length, a cyst is the result.

A carcinoma may develop from this cyst wall. If glandular in type, it is from the entoderm, while an epidermoid may take its origin from this membrane or the ectoderm.

Even when the clefts close in the normal manner, it is easy to conceive that these epithelial linings are included in the tissues of the neck, and become embryonal, or cell rests, from which a carcinoma may later arise.

Speese[1] says: "These plates form the four branchial arches, three clefts remaining between them which, in early life, unite, with the exception of the second." (First.) "From this one is formed the cavity of the tympanum, the eustachian tube, and the external auditory canal." He concludes: "It is now generally admitted that lateral fistulas originate from the second branchial cleft."

[1] Speese: Contributions from the Laboratory of Surgical Pathology, University of Penn., p. 10.

[2] Bailey and Miller: Text-book on Embryology, p. 147.

Bailey and Miller[2] read: "The first branchial groove is relatively large and marks the site of the external auditory meatus." They continue, p. 621, "It sometimes happens that during the closure of the branchial grooves portions of the walls of the grooves become enclosed within the walls of the pharynx, that is, within the sides of the neck. This abnormal process results in various forms of cysts and tumors. If derived from the external furrows, they are dermoid in character, lined with ectodermal derivatives, and contain sebaceous material. If derived from the internal furrows they contain mucous fluid, the lining epithelium is likely to be columnar and is claimed by some to be ciliated."

Prentiss[3] says: "The external ear is developed from and about the first branchial groove." He continues, p. 170. "By the growth and lateral expansion of the pharynx, the second pouch is taken into the pharyngeal wall, its dorsal angle alone persisting to be later transformed into the palatine tonsil."

The third branchial cleft gives rise to the parathyroid bodies and the thymus gland. So, epithelial tumors arising lower in the neck may either have their origin in one or the other structures, or from some of the epithelial inclusions from this third cleft.

There is also a rudimentary fourth cleft and fifth arch from which post-branchial carcinomata may take their origin.

Some writers have been a little backward in ascribing the development of these neck tumors to epithelial embryonic inclusions. Morris[4] makes this point clear when he says:

"What proof have we that a matrix of embryonic tissue, whether of embryonic or acquired origin, can remain for a length of time in a quiescent state, and then suddenly start into active growth under the influence of some stimulus? This is actually witnessed in the growth and development of the teeth, bones, the skin and its appendages, the larynx, the mamma, and the organs of generation, the cells of which remain for years in a state of incomplete differentiation, and then normally, under the physiological stimulus which occurs at puberty, take on rapid proliferation. Pathologically, the same suddenly aroused activity is seen in certain epithelial tumors which are rarely noticed before puberty, such as dermoids and mammary adenomata. Rudimentary organs, which hitherto as to growth have been stationary as well as functionless, become the starting points of tumors, more especially at and after puberty."

The following case of epidermoid carcinoma, seemingly taking its origin from epithelial embryonic inclusions of the second gill cleft, occurred in my practice:

F. A. W., male, aged forty-nine, consulted me July 25, 1915, on account of a lump on the neck, in the upper triangle, just in front

[3] Prentiss: Text-book on Embryology, p. 387.

[4] Henry Morris: Cancer and Its Origin, British Med. Jour., December 12, 1903, p. 1505.

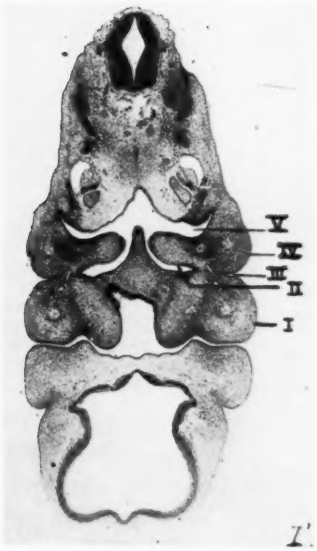

FIG. 1.—Transverse section passing through first and second pharyngeal pouches of a 9 mm. pig embryo. I, IV, branchial arches, first and second; III, first branchial cleft; II, first pharyngeal pouch; V, second pharyngeal pouch.

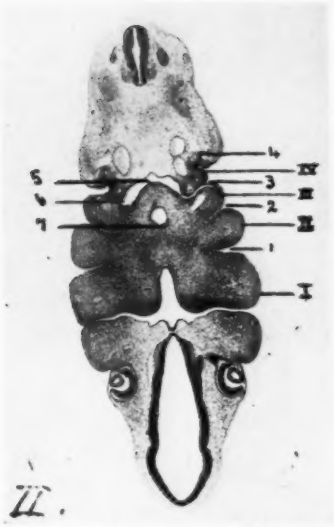

FIG. 2.—Transverse section passing through third pharyngeal pouch of a 9 mm. pig embryo. I, II, III, IV, branchial arches; 1, 2, 3, 4, branchial clefts; 5, pharynx; 6, third pharyngeal pouch; 7, anlage of the thyroid gland.

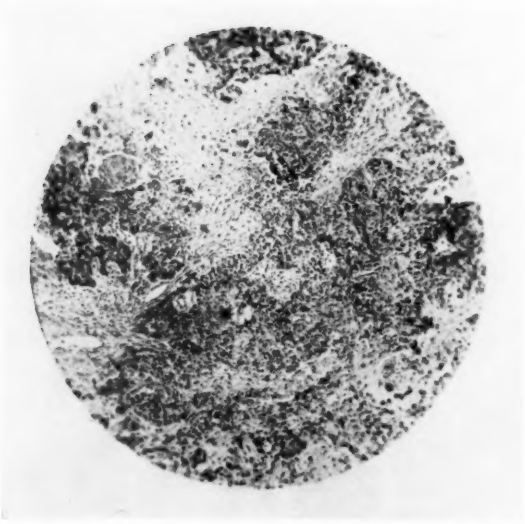

FIG. 3.—Photomicrograph of section from tumor. Note the formation of epithelial pearls.

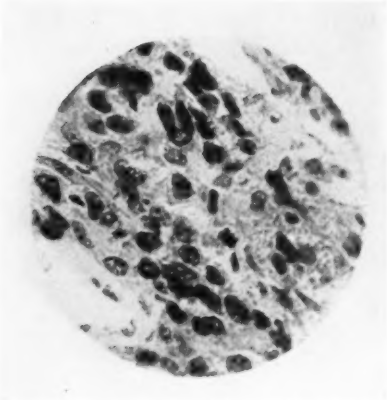

FIG. 4.—Note the mitotic figures in this area of the carcinoma.

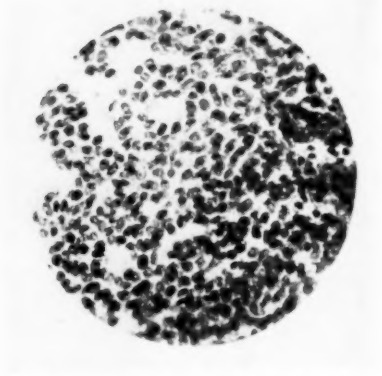

FIG. 5.—Photomicrograph of section through one of the most cellular areas in a mixed tumor of the parotid gland.

of the sternomastoid muscle and immediately below the ramus of the jaw. He had only noticed this lump two weeks before. Pain in the region of the growth was a very prominent symptom. I recommended immediate operation, which was accepted, after first having taken a few days to arrange his affairs. On August 2 I operated, removing the mass by a somewhat radical operation. The tumor proved to be an epidermoid carcinoma, and from its situation, and its freedom from epithelial structures, must have taken its origin from the second branchial cleft, from resting cells of fetal origin.

The tumor showed microscopical evidence of very rapid growth, in that the epithelium presented many mitotic figures, and the cancer cells having very little supporting connective tissue. It reoccurred within three weeks, and another surgeon operated on him after I had declined to undertake another operation for the recurrence, feeling it would do no good in the face of its wonderfully rapid development. This second operation was done October 20, less than three months after the first operation, and a little over three months since the first manifestation of the disease. He died on the operating table. No secondary manifestations had declared themselves. No postmortem was obtained.

No member of the family, or collateral branches, were ever known to have developed cancer. Nor did any member ever die under circumstances that would lead the physician to believe any of them had ever died of cancer, yet the cause of death was ascribed to some other disease. His father died at the age of seventy-six, from pneumonia; his mother at the age of seventy-five, from some sort of bronchial disturbance of ten years' duration. Of the six children, one died in infancy. The other four are living and well, all older than the patient under consideration. So, whatever was the cause of the cancer in this case, heredity did not manifestly play a part in its causation, without there had been a previous recession of hereditary features.

The diagnosis of branchiogenic carcinoma is not easy, nor indeed possible, in many cases before operation. Its location in the accepted region of the second branchial cleft, just below the jaw, and in front of the sternomastoid muscle, together with the fact that the tumor is beneath the deep fascia, and that the mass is hard and associated with pain, are all things that are helpful in determining the diagnosis.

One must make sure that the growth is primary and not secondary in character. It is easy to overlook some primary focus of infiltration.

Von Bergmann [5] pointed out three diseases which may be mistaken

[5] Von Bergmann: Syst. Practical Surg., p. 120.

for branchiogenic carcinoma: "Lymphosarcoma, tuberculous lymphoma, and actinomycosis." Sarcoma is more apt to be soft on pressure than tuberculous glands, which may be quite hard on pressure. But both of these diseases are much freer from pain than branchiogenic carcinoma.

If a branchiogenic cyst has been present for a long time, and suddenly undergoes the change of showing a hard area, together with associated pain, suspicion should at once be aroused as to the probability of a carcinomatous growth having begun. The same author just quoted reports a case of this type having developed on a cyst wall. He has also made it clear to us that a cyst of the neck may have an entirely different origin than the branchiogenic cyst. Notably in this class are the congenital serous cysts. In discussing these cysts, von Bergmann continues: "These tumors develop by continual dilatation of the lymphatic vessels, as demonstrated by Koster in 1872, and later by Winiwarter and Wegner. They were called lymphangiectasia congenita (Koster) or lymphangioma cystoides (Wegner). The tumor consists of multiple cysts lined with epithelium, and contains a clear serous fluid that coagulates on standing."

Sebaceous cysts, dermoid cysts, blood cysts, and echinococcus cysts substantially complete the list of cysts of the neck, in addition to the ones already described.

Richardson [6] has pointed out some of the difficulties in diagnosing primary branchiogenic carcinoma in its likelihood of being confused with certain primary tumors in other situations, giving a secondary tumor in the neck by metastasis. He says: "Probably the most difficult are metastases from carcinoma of the parotid or submaxillary salivary glands. Primary tumors in other structures, thyroid, pharynx, larynx, carotid body, face, mouth, nasal cavity, tongue and more rarely œsophagus or even stomach with cervical metastases, must be considered and excluded if possible."

Many cases of branchiogenic carcinoma cannot be diagnosed in advance of operation, or postmortem; but usually one can arrive at a fairly accurate opinion of the type of the trouble if one carries in mind the many difficulties of diagnosis and secures a fairly accurate history of the case.

In making a differential diagnosis of branchiogenic carcinoma, one must always think of endothelioma. Wingrave [7] says that during the last year he has examined several growths, belonging to the tumors described as endotheliomata, removed from the cervical and parotid

[6] Richardson, Maurice L.: Cleveland Med. Jour., September, 1915, p. 583.
[7] Wingrave, Wyatt: A. M. A. Jour., vol. xlviii, 1907, p. 1281.

regions, and from the upper respiratory and digestive tracts. These tumors, he asserts, may be defined as neoplasms developed from the following type of epithelioid or mesothelioid cells, such as are found lining blood- and lymph-vessels. The tumors are also said to arise in vestigial structures, such as occur in connection with the branchial clefts on and in the intercarotid gland, probably from angioblastic elements.

Still, one must be careful to differentiate these endothelial tumors from certain other conditions, such as mixed tumors of the salivary glands and from tumors of the carotid body. It is only within recent years that tumors of the carotid gland have received much emphasis, and so some of the peritheliomatous growths of the older writers on tumors of the neck may in reality represent neoplasms of this organ.

Embryologically considered, the carotid body is a derivative of the chromaffin system. It has been confused as a derivative of the epithelial tissue arising from the third branchial cleft, but closer study has shown it to possess the peculiarly staining cells that are characteristic of the chromaffin group of cells.

Carotid tumors are frequently confused with other growths. Fee,[8] in speaking of carotid tumors, says: "Tumors of this gland are not easily diagnosed, as shown by the early reports. They have been mistaken for enlarged lymphatic glands, lipoma, and even goitre. In my own case, I had made a diagnosis of carcinoma of the thyroid gland."

In determining the prognosis, therefore, the exact location, the character of the structures involved, and the histological picture of the particular tumor under study must be given consideration. The histological study should determine the following points:

1. The presence of mitotic figures.
2. The degree of differentiation of the cells.
3. The extent of the invasion, *i.e.*, the study of the capsule, if there be one present.
4. The presence of tumor cells in the lymphatics or blood-vessels.

The prognosis of branchiogenic carcinomata is grave indeed. McKenty,[9] in reporting five cases having occurred during fifteen years in the Royal Victoria Hospital, Montreal, says: "The mortality was 100 per cent. This is partly due to the situation, where so many important structures are early involved, and also to the extreme malignancy of the tumor."

All writers are in accord with McKenty in the main, that the prognosis is at least very grave.

[8] Fee, Frank, M.D.: Johns Hopkins Bulletin, May, 1912, p. 146.

[9] McKenty, F. E., M.D.: Surg., Gyn. and Obs., August, 1914, p. 141.

SUMMARY

1. The first branchial cleft is concerned in the formation of the external ear and the eustachian tube.

2. The tonsil is formed from the second gill-cleft, which, on failure to close, gives rise to either a fistula or cyst, from the walls of which a carcinoma may develop.

3. The thymus gland and the parathyroid bodies are formed from the third gill-cleft. When a cyst, fistula or carcinoma develops from the epithelial lining it will appear lower in the neck than similar disturbances arising from the second gill-cleft.

4. The rudimentary fourth gill-cleft, or the fifth arch, may give rise to a post-branchial growth.

5. Carcinomata may arise from embryonic epithelial inclusions of any of the gill-clefts.

6. When a cancer arises from the second cleft, it is situated just below the angle of the jaw and in front of, or just under, the sterno-mastoid muscle.

7. Tumors of the carotid body may develop which will require differentiation from gill-cleft carcinomata. In doing so, one should remember that the carotid body belongs to the chromaffin system.

8. Endotheliomata likewise require especial thoughtfulness in diagnosing, which can be done only when the morphological cell structure is studied.

9. A common source of error, preceding operation, is to mistake these various neck conditions for enlarged lymphatic nodes.

10. When a branchiogenic cyst has been in existence for some time, it is not unusual for a carcinoma to develop on the wall of the cyst.

11. Lymphangioma, sarcoma, cystic goitre and secondary carcinoma of the lymph-nodes, or other structures, are to be thought of in making a differential diagnosis.

12. When a cyst appears in the middle of the neck, above the thyroid, it is probably from an unclosed foramen cæcum, from which the thyroid gland is developed.

13. If a branchiogenic carcinoma is glandular in type, it has been derived from embryonic inclusions of epithelium derived from the infolding of the entoderm forming the inner clefts; if squamous celled, it is derived from either entoderm or ectoderm.

CONCLUSIONS

1. The mortality of branchiogenic carcinomata is very high. This is probably quite as much due to the start it gets before operation, owing to its deep seat, rendering diagnosis so difficult, as to any extreme malignancy of the growth, although this is sometimes very great.

2. In rapidly growing branchiogenic carcinomata, the cell differentiation may be so imperfect in many fields as to simulate tumors of endothelial origin. Other fields usually clear up this uncertainty.

3. Operations for the relief of branchiogenic carcinomata are always serious, owing to their attachment to deeper structures, which may require removal. Both the carotid artery and jugular vein may be injured to an extent requiring the removal of a section; the pneumogastric nerve may be injured at the same time.

4. The only hope for making any satisfactory reduction in the mortality rate following operations for branchiogenic carcinomata is to operate earlier in their progress.

5. Any hard swelling in the region of the branchiogenic clefts should immediately arouse suspicion of branchiogenic carcinoma, especially if associated with pain as a prominent symptom.

THE THERAPEUTICS OF CHRONIC NON-TUBERCULOUS SUPPURATIVE BRONCHIECTASIS *

By Howard Lilienthal, M.D.
of New York
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Before this assembly it is not necessary to enumerate and discuss the various forms of pulmonary non-tuberculous purulent infection. To do so would take up most of the evening and would probably contribute nothing new to your knowledge. Garré and Quincke,[1] Lord,[2] and a number of others, have dealt exhaustively with this subject.

I wish to confine myself to the sad cases of those patients who, having tried the best that medicine affords, are left to look forward to a future of cough and foul expectoration, to periodical attacks of septic fever, to the repeated terror of pulmonary hemorrhages—and to the heart-breaking disappointment of an unproductive life.

The most frequent form of this disease may be considered primarily bronchiectatic in character, though later the cavities, perhaps never entirely free from some mucous membrane lining, become more nearly like true abscesses with indurated cicatricial walls whose rigidity, even in the absence of pleural adhesions, would resist all possible gas compression therapy.

While the actual mechanical causes of bronchiectatic dilatations can only be surmised, it is known that the disease may follow almost any bronchial infection, whether occurring originally within the tube or coming from the surrounding parts—lung, abdomen, pleura, rib. Certainly, it seems as if in some instances the dilatation were due to septic destruction or weakening of the bronchial wall.

The long-continued presence of a foreign body in the bronchus will almost invariably cause suppurative bronchiectasis.

At a recent meeting of the New York Academy of Medicine, Llewellys Barker [11] stated that a certain number of these cases were of syphilitic origin and amenable to antiluetic treatment, a most interesting and important observation. In my service at Mt. Sinai Hospital it has been our custom to make blood tests in all these cases. Thus far none has shown the presence of lues, and but one patient in private practice gave a history of the infection.

Postoperative bronchiectasis following tonsillectomy and removal

* Read before the Chicago Medical Society, March 29, 1916.

of adenoids, in *general anæsthesia,* and particularly in adults, has been exemplified in eight cases within a few months at Mt. Sinai Hospital. Wessler [3] says that 28 per cent. of all lung suppurations coming to the radiographic department of Mt. Sinai Hospital followed operations of this character. While most of these patients recovered spontaneously or under hygienic and supportive treatment, some were medically hopeless and could be relieved or cured by surgery only.

In a paper read by Manges before the Laryngological Section of the New York Academy of Medicine on January 26, 1916,[4] he dwelt upon this sequel of tonsillectomy. In the free and warm discussion which followed various opinions were advanced. Yankauer believed that much of the blame was to be laid upon insufficient preparation for the operation, a fault too common in hospitals. This resulted in the vomiting of food during the operation and in the aspiration of foreign particles. He believed that operating with a continuous suction tube in the pharynx would eliminate the danger of aspiration of blood and of the septic material pressed from the tonsil during tonsillectomy. Coakley, because of the freedom from such complications following his operations in which general anæsthesia was employed without suction, regarded the anæsthetic as having no important relation to lung abscess of this variety. He called attention to Scudder's reports of lung abscess [5] which followed other than throat operations.

Others present blamed unskilful sponging and swabbing, which plugged the throat at the time of inspiration.[a]

The writer, who took part in this discussion, was convinced that the aspiration of septic matter, or bits of tissue from the tonsils or adenoids, caused localized bronchiectasis or bronchopneumonia with subsequent abscess formation, and that such aspiration was much more liable to occur because of the absence of reflexes in full narcosis than in operations performed with the aid of local anæsthesia. He also went so far as to advance the suggestion that in children too young for a radical operation without narcosis the diseased tonsils should be treated by tonsillotomy without anæsthesia, and that the radical operation should be postponed until early adult life, when local anæsthesia could be employed. This general rule may be broken in cases of exceptional urgency, but in any event continuous suction during the operation should not be omitted.

The argument may be advanced that every mouth contains patho-

[a] A. N. Strouse, of New York, in a personal communication, stated that much of this danger could be averted by preparing the tonsils some days before tonsillectomy; pressing out plugs and disinfecting crypts and follicles.

genic germs, yet that suppurative lung infections are rare after surgical work in distant parts of the body, even in narcosis. But it must be remembered that pneumococcus infections in these circumstances [6] are not uncommon, while abscesses are rare. Also, that the enormous implantation which could easily follow the aspiration of the contents of diseased tonsil follicles might kindle a suppurating infection which the mere aspiration of slightly infected mucus and saliva would not accomplish.

Diagnosis of Chronic Lung Suppuration.—The most important sign of this disease is the cough with easily-raised, profuse, mucopurulent sputum, and with complete remissions of from several hours to one or more days. As a rule, the discharge is foul, though there may be two or more kinds of sputum from cavities in the lungs of the same individual, some with fetor, some without much odor. The pungent, penetrating stench of acute gangrene, is, however, absent. The quantity varies, but 500 c.c. or more may be coughed up in twenty-four hours.

Even in this non-tuberculous disease elastic fibres are often found. The flora of the cavities is abundant and varied.

When the cavity fills with secretion, there may be irregular elevations of temperature which recede with the drainage accomplished by the periodic emptyings.

The general nutrition of the patient may not be impaired, though this depends largely upon the degree of sepsis. The fingers, however, become characteristically clubbed, and this deformity may vanish with the cure of the disease (Figs. 4*a* and 4*b*).

The physical signs are too well known to require reiteration here, but the X-ray will frequently show changes not clearly demonstrable by the older methods. Even with the X-ray, one cannot invariably make close differentiation. The radiograph must be taken with the history and with that most important recent diagnostic acquisition, the bronchoscope.

In estimating the character and extent of the infection it is highly advisable to make an examination with this instrument. It may establish the presence of dilated bronchi and it can show in which lobe of the lung lies the source of the discharge. Unsuspected and radiotransparent foreign bodies may be extracted, with consequent cure of the disease. New growths may be grossly diagnosed and specimens removed for microscopical examination.

Irrigation of the cavities has been practised by Yankauer with the aid of one of his ingenious devices, which washes without drowning. Relief for several days may follow this procedure, and it may be found useful as a pre-operative measure.

Treatment.—General treatment by medical means is justifiable if guided by the clinical course of the case and by the radiograph; but when, after months of conscientious work, it becomes clear that failure is inevitable, no more unnecessary time should be lost in a therapy which, after all, amounts to little more than simple observation. A surgical consultation should be held and a conclusion reached as to the suitability of operation for the case in hand. The location and the anatomical distribution of the lesions, as shown by X-ray and bronchoscope, are of the greatest importance. In the present state of surgery advanced bilateral chronic pulmonary infection should forbid radical operation and the surgeon should decide whether, even in a unilateral case, the disease may not perhaps be too far advanced.

The functional condition of the other vital organs and any coexisting pathology which might prejudice the result must be considered.

And here it may be well to sound a warning against the pernicious practice of diagnostic puncture before the actual time of operation, radical or exploratory. Puncture cannot do good and it may result in the most serious complications. It may be a delicate matter to bring home to the physician this important fact. The medical man may be averse to turning his patient over to the surgeon—unfortunately often regarded as a mere operator—until the diagnosis has been made with the greatest possible accuracy.

This " refinement," however, is quite unnecessary, to say the least, and it has a direct mortality from the occasional unavoidable injury of blood-vessels and nerve trunks, not to speak of infections of the pleural sac.

Now, let us imagine that a case of bronchiectatic lung suppuration has gone on for six months with no sign pointing toward a healing process, and with the short remissions which only accentuate the misery of the patient. Let us also suppose that the X-ray and bronchoscope point to a localization in a single lobe with little or no involvement of the opposite lung. This would, then, be a case suitable for the radical extirpation of the infected part. To wait longer would probably subject the patient to the danger of extension of the process in the same lung, or even to the opposite chest, with the establishment of an incurable condition.

Palliative operations are almost or quite as dangerous as extirpation, and the improvement is rarely such as to enable the patient to go about his work as he did before his illness. Often scoliosis from multiple rib resections makes the patient an incurable cripple.

Extirpation, while surely a capital and a dangerous procedure, does

hold out the hope of actual cure. The gravity of the procedure must be explained to the friends or family, but in discussing the case with the patient only the hope of a restoration to complete health should be dwelt upon.

In the early days of operating for appendicitis, cholecystitis, and many other surgical conditions, we began with the most hopeless cases, gradually winning our way until we arrived at the present gratifying stage, when early diagnosis is followed by prompt and successful surgery. So for the present we must be satisfied to operate in the *worst* and most hopeless cases of lung suppuration, where there is little to lose and much to gain. Later, with improvement in the technic, we may find that lung surgery is no different from other surgery and that we shall operate in the early cases with greater promise of cure. The fact that some lung abscesses get well without operation may be misleading. Appendicitis—even intussusception—may disappear spontaneously, yet that is a poor argument for withholding operation. A patient recovered from a well-established condition of suppurative bronchiectasis or chronic lung abscess must be watched for a long time before he may be pronounced well.

After a fairly wide experience,[7] amounting in all to more than twenty-six cases since 1910, I am convinced that palliative treatment should be reserved for actually hopeless cases, such as those of bilateral involvement or those in which the condition in one lung is so extensive and complicated by adhesions that extirpation is clearly impossible.

A single focus, or multiple foci in one lobe, should be removed surgically. And even when an abscess has extended so as to implicate neighboring lobes in one single infected mass, it has been shown that extirpation may be successfully performed (Cases III and V).[b]

Methods of Procedure.—The method which I have employed in my radical operation for lung suppuration differs materially from that which has been generally described and adopted. Although my cases are few, the results do not suffer by comparison with the published records of others. The work is so new that, if eventually we are to evolve a satisfactory technic in these difficult cases, each of us must contribute by recording his experiences whether the results are good or bad.

First, then, as to the preparation of the patient. If the case is one in which posture will cause a partial or complete emptying of the cavities, the patient, during the twenty-four hours preceding the operation,

[b] Lenhartz[13] evidently errs in limiting the indications for resection to cases in which but one lobe is diseased.

should free his lungs of as much secretion as possible. About one hour before the operation a dose of morphine and atropine is given, as much for its quieting effect upon the mind as an aid to anæsthesia. Before administering the anæsthetic, the thighs close to the body are compressed with ligatures or, better, rubber bandages, so as to cut off the venous return and segregate as much blood as possible in the lower extremities, which should become deeply cyanosed. This method, employed by the late Dr. A. L. Loomis in the treatment of hæmoptysis, was revived by the late Dr. Dawbarn as a preliminary to bloody operations. I have made experiments which demonstrate that the blood-pressure may be reduced as much as 60 points by this means. When the ligatures are removed the normal pressure is not reëstablished for from 30 to 60 minutes. Permitting the blood to flow back after the operation has much the same effect as a transfusion with unetherized blood, so that the patient quickly recovers from the narcosis.[c]

Ether has been very sparingly used, although sometimes it is necessary to resort to it in the beginning, until unconsciousness has been established, when we proceed with nitrous oxide and oxygen. Team work of anæsthetist and operator is essential, and this can best be secured by working regularly with the same anæsthetist. He will learn to understand the operator, and the surgeon, with increasing confidence, will not have his attention divided between the operation and the anæsthesia. If ether is to be used at all some sort of insufflation apparatus is indispensable.

Early in my work I was convinced by Dr. Branower, one of my anæsthetists, that the intrapharyngeal method had advantages over any other with which I had experience. Pressure is never so great as to cause apnœa, quiet respiratory movements going on constantly; yet the pressure may be increased sufficiently to distend the lung to any required degree by the simple expedient of closing the mouth of the patient. Although I have employed the intratracheal insufflation method from the first and, in fact, in the very first case in a human being in which this method was employed,[d] [8] I have concluded that in operations upon one lung the intrapharyngeal method is safer and easier of application; also, since natural movements of inspiration and expiration occur, the theoretical danger that septic material may be blown from the throat into the

[c] This method of reducing blood-pressure is of value in hemorrhage from any other causes—typhoid intestinal bleeding, gastric hemorrhage, etc.

[d] Note—If nitrous oxide and oxygen are employed, there will be a sufficient blowing force as the gases are liberated from their containers.

healthy lung may be disregarded.* I am well aware that in making this statement I have but little material on which to base my conclusion, and would reserve the right to alter my opinion with further experience.

Position of the Patient.—The subject should lie upon the healthy side or a little over towards the prone posture. With intrapharyngeal insufflation there is little if any danger of embarrassment of respiration. It is at times convenient to raise the head of the table, either at the beginning or during the operation, if access to the thoracic cavity seems to be aided thereby.

In all my cases disinfection of the skin was secured by the iodine method.

The Incision.—In operation on the lower or middle lobe an incision in the seventh or eighth interspace, beginning at the angle of the ribs and running forward to the anterior axillary line, or even farther, will give free exposure. The line of incision should be near the upper border of the lower rib so as to keep away from the intercostal vascular structures. I have not had the opportunity to resect an upper lobe. Having divided the muscles down to the endothoracic fascia, the ribs are separated with blunt retractors and the pleura incised with great care so as to avoid the unintentional wounding of a possibly adherent lung. I have usually entered the pleura near the posterior end of my incision and, inserting the finger, have quickly enlarged the opening forward with scissors. The rib-spreading retractor is now adjusted and the ribs are slowly forced apart.

If, in spite of a long incision, the ribs cannot be separated sufficiently for easy access, or if the selected interspace proves, on exploration, to be too high or too low, costotomy of one or more adjoining ribs, at either end of the wound, above or below the incision, will give ample room.

Inspection will now reveal the dusky red diseased part in strong contrast to the normal lung, and the observation will be confirmed by palpation.

Adhesions between the lung and parietal pleura are nearly always present and the mobilization of the focus of infection must be managed with caution. Oozing hemorrhage is apt to follow the peeling away of membranous adhesions, while the more massive or cord-like ones often contain vessels which require ligation.

Before dividing any adhesion, whether bluntly or by dissection, one must be sure that there is an easy approach to any point of possible

* In three cases of œsophageal intrathoracic surgery this intrapharyngeal method gave perfect satisfaction. In one of these operations there was a large opening into the right pleural sac through the opened left chest, yet no untoward symptoms developed.

hemorrhage, for the expedient of pressure packing with gauze is hardly available in endothoracic surgery.

The diseased part of the lung once freed from its adhesions to the chest wall, it will probably be necessary to isolate it from an adjacent healthy lobe. This may be done bluntly or with dissecting scissors. Compression or rough handling of the abscess is dangerous, for partially-eroded vessels of great size may be torn through, with almost instant death.

Adhesions between the uninvolved lobes and the chest wall should not be disturbed. Their presence is a safeguard against the collapse of the lung and also against the dangerous so-called "fluttering" of the mediastinum.

In removing an entire lobe the question of the greatest importance is the treatment of the structures at the hilum. Garré and Quincke, Meyer[9] and others have advised that the vessels be isolated from the bronchus and secured by individual ligation, the bronchus itself being crushed and ligated and the stump inverted and buried. We are warned that this stump must be held by suture to the surrounding parts to prevent its withdrawal into the mediastinum, with the subsequent formation of pneumomediastinum in case of air leakage. In resection of the lung for non-inflammatory conditions, such as tumors, and in experimental work on normal animals, this method, followed by closure of the wound in the chest wall, is probably feasible; but in these infected cases I have found the structures of the hilum matted together by the organized plastic products of inflammation so that dissection has appeared to me laborious, time-consuming and perilous. I, therefore, have proceeded by crushing the entire pedicle with a powerful clamp, which was then removed and the crushed pedicle secured with chain ligatures of strong chromicized catgut. Now, cutting away the lobe, the vessels were separately secured beyond the ligature and the bronchial stumps carbolized, and also once more tied, but with no attempt to invert.

If there are no adhesions between the remaining lobes of the lung and the chest wall, it will be necessary to fix the stump in such a way as to prevent flapping of the mediastinum. I have done this by placing a suture or transfixion ligature through the stump, distal to the main ligature, and fastening it not too tensely to the chest wall entirely outside the wound. Leaving the two ends long, tying them together, and running a safety-pin through the loop, the pin is fixed outside the wound, but dangerous traction is to be avoided. Very little force is sufficient to steady the flapping mediastinum. If there are massive adhesions between the remainder of the lung and the chest wall this ligature will

not be necessary, although its application is not an unwise precaution.[1] A single packing of gauze is laid against the stump and led out of the wound.

The spreader being now removed, a few chromicized catgut sutures through the muscles will approximate the ribs sufficiently without pericostal or percostal sutures, and the skin may be closed with silk, leaving draining space for the ligature which supports the mediastinum and for the gauze.

Believing it to be quite hopeless to try to prevent infection in these cases, I have accepted the inevitable and merely provided for ample drainage. The dressing consists of gauze padding, held in place with adhesive straps which confine the diseased side only, no turn of bandage encircling the body. Respirations are kept down with morphine.

Convalescence is pretty sure to be stormy. For the first few days there is a seropurulent discharge, and it may even be necessary to insert a tube alongside the gauze. The ribs will remain separated an inch and a half or more, gradually approaching each other, for from five to ten days. The slough of the stump will come away in due time, and in three of my cases there was a temporary bronchial fistula, the opening, naturally, far from the chest wall. This seems to close of itself as the diaphragm rises and the remainder of the lung expands and the cavity becomes obliterated. Indeed, I am not sure that the open bronchus may not be a temporary advantage because of the drainage afforded during the healing of the lung.

If a free discharge of pus occurs during the convalescence, I have used a graduated suction apparatus of about six inches of mercury, not only to remove the discharges, but because I believe the drying out of the wound by the current of air stimulates granulation and promotes healing. The apparatus used in my cases was made by Sorensen of New York.

My cases have all shown tachycardia after the operation, but this is a symptom which is frequently present before surgical intervention, often persisting for months.

The technic here described must be modified according to the case. For example, when I have removed a diseased focus by resecting a part of a lobe, or even a part of three lobes (Case 3) in one piece, I have

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[1] The mediastinal flapping is caused by the respiratory efforts of the healthy side, which draw the soft mediastinal tissues toward the sound side on inspiratory movements, bulging them toward the opened side on expiration or on pressure with the closed glottis. As long ago as 1887, C. Bayer[10] devised the method of pneumopexy to steady the mediastinum during thoracic operations.

done it by crushing the healthy lung beyond the abscess and placing chain ligatures of chromicized catgut in the crushed area, crushing only a little at a time, ligating and then proceeding to the adjacent part successively, until finally the entire focus is surrounded by chain ligatures. The abscess is then cut away through infected tissue, which will later be cast off. The stump, no matter how large, is thoroughly carbolized with applications of 95 per cent. phenol.

I am aware that this procedure makes but little attempt at surgical asepsis. But when it is recognized how difficult it is to prevent infection of the free pleural cavity, in the presence of even the smallest amount of septic matter, it appears to me far safer to admit the conditions as they are and provide for the infection when it arises. I have carefully considered the possibility of operating in two stages, and perhaps some safe method of accomplishing this may be devised. Up to the present I can conceive of no two-stage procedure which would not also involve the formation of adhesions, and in thoracic work these are more difficult to deal with than in the surgery of any other part.

In forty-eight hours gauze packings in the clean pleura are so firmly adherent that great force is necessary to withdraw them. Perhaps surrounding the lung with rubber dam between the stages may prove effective.

When the wound has become simplified, but healing is slow, I have found that the injection of 5 per cent. iodoformized vaseline stimulates repair and greatly reduces the quantity of discharge.

The barrel of a large-nozzled glass syringe may be filled with the ointment after removing the piston; then, replacing the piston, the vaseline in its natural state—not liquid—can easily be forced from the nozzle.

Iodine or other irritants must not be injected into these cavities for fear of their entering a bronchus. An alarming spasm of coughing may result.

The writer has found full open-air treatment of the greatest benefit, the change in the appearance and general behavior of the patients being most striking, even after but a few days and nights in the open.

When the wound has healed there must still be a period of careful observation. Active exercise had better be forbidden for a number of months and a tendency to cough treated with small regular doses of opiate, preferably heroin or codeine, for severe coughing is apt to force a reopening of the wound.

Two short tables accompany this paper, and there are also the reports of seven cases in which extirpation was performed or attempted.

Of the six cases in which the operation could be completed there were four cures.

One patient, whose case was badly chosen for extirpation, died as the result of an exploratory operation.

But compare this with the report of twelve drainage or "conservation" operations, with but one cure, five so-called "improvements," which were merely a modification of the degree of invalidism, and six deaths. Surely this speaks clearly for "radical" surgery.

Probably in no disease is restoration to health more deeply appreciated than in chronic pulmonary suppuration. The surgeon will have an anxious time and there will be weeks and months of unremitting, conscientious work; but to bring one of these wretched outcasts back to happy, useful life, carries with it a reward the like of which is offered in no profession but that of medicine.

CASE I.—*Bronchiectasis of Entire Right Lower Lobe. Lobectomy. Cure.*

Francis W., a little boy, three years and nine months old, was referred to me by Dr. Yankauer, who had been treating him bronchoscopically for the extraction of foreign bodies—pieces of nut which he had aspirated into his lung a year before. There had been cough, expectoration and fever. The temperature ran in irregular waves, often reaching as high as 105 degrees. The bronchoscope had demonstrated abnormal secretions from the right lower lobe. The X-ray showed a general opacity at the right base, extending up to the eighth rib (Fig. 1).

First operation, Tuffier's Living Fat Implantation: On January 23, 1914, the tube for intratracheal anæsthesia was put in, but it was too large, so it was removed and anæsthesia continued by the intrapharyngeal method. Long incision between eighth and ninth ribs down to, but not through, the pleura. Pleura dissected away from the endothoracic fascia and a part of the ninth rib resected to make room for the finger, so as to continue the pleural separation. Three pieces of fat from the abdominal wall of another patient were utilized to fill a cavity large enough to contain about forty cubic centimetres. Wound closed without drainage.

The patient was not improved, and it was hardly to be expected with so small an implantation. A minute extrapleural sinus persisted. Second operation on February 27, 1914. Intrapharyngeal ether anæsthesia by Dr. Branower. Long seventh space incision into the pleura. The fat which had been transplanted was alive and in position. The lower lobe of the lung was

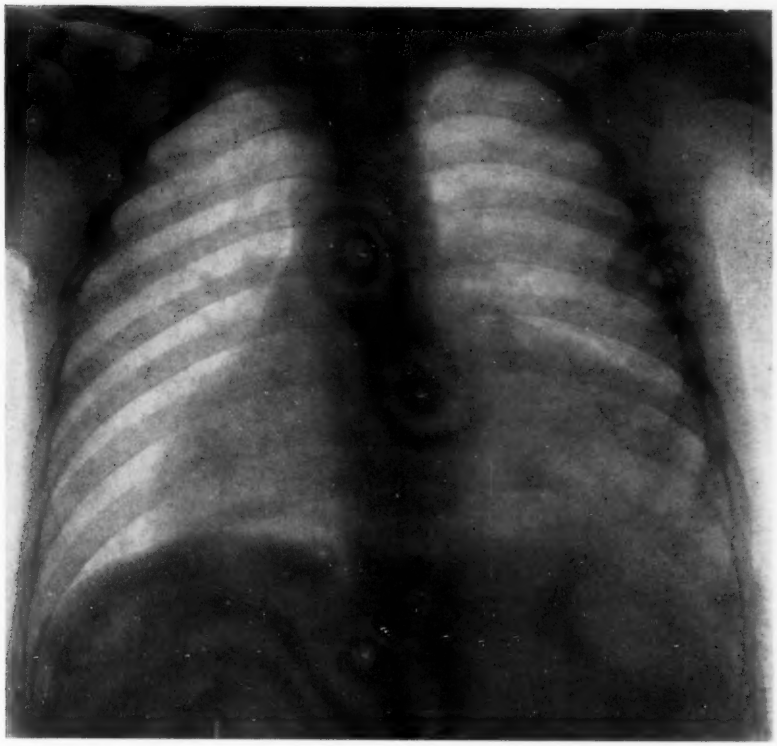


FIG. 1*a*.—Case I. F. W., before operation. Note opacity corresponding to right lower lobe.

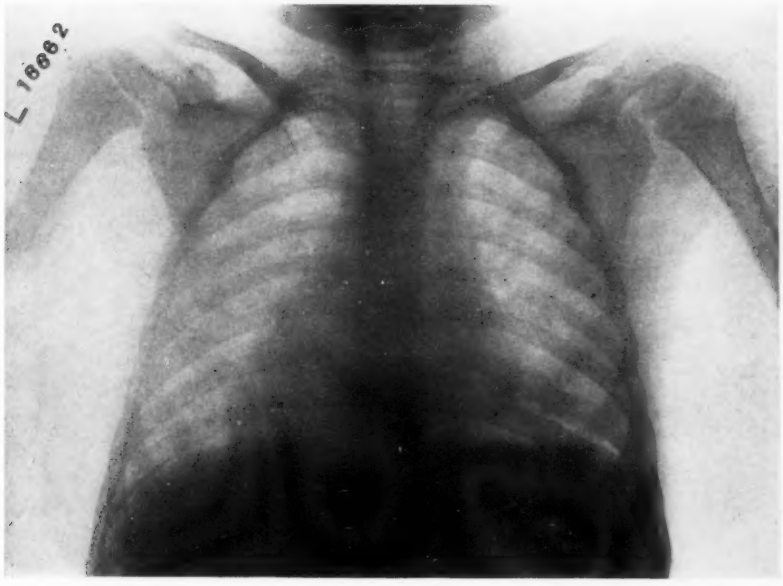


FIG. 1*b*.—Same case, about a year after operation. Chest almost normal.

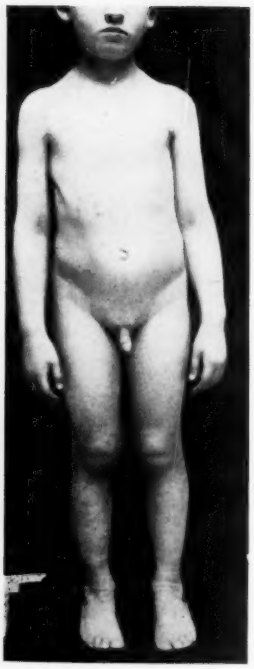
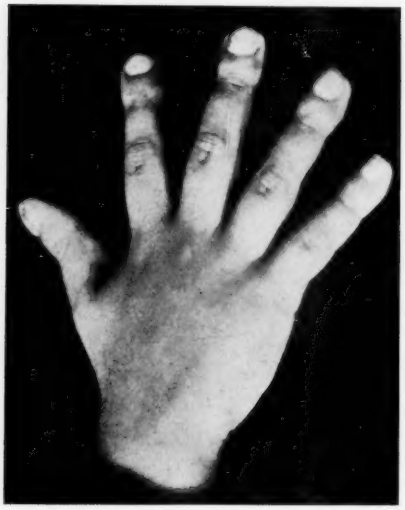


FIG. 2.—Case I. F. W., two years after excision of lower lobe of right lung. Note symmetry of development.

FIG. 3.—Case I. F. W., same date as Fig. 2. Note freedom of shoulder function.



a

b

FIGS. 4*a* and 4*b*.—Hand of F. W. (Case I) soon after operation and at expiration of a year.

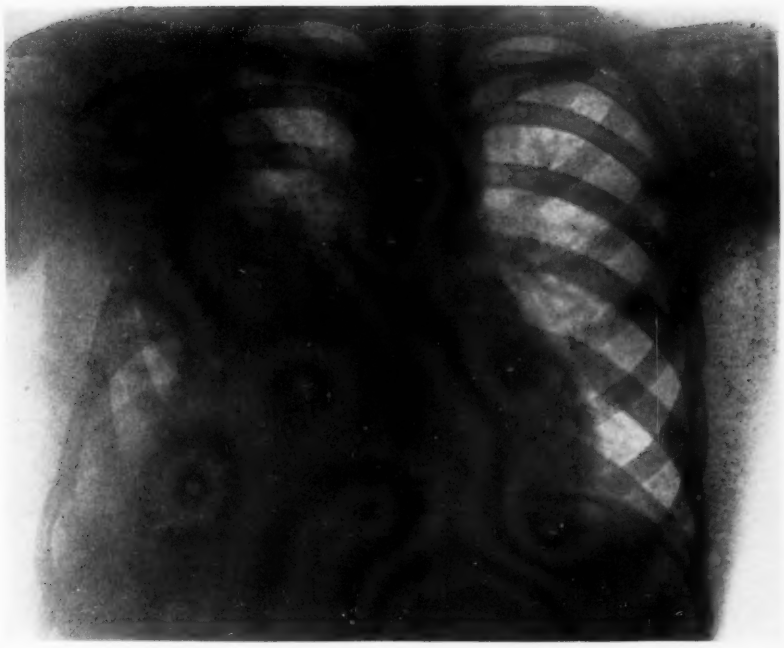


FIG. 5.—Case III. David J., before operation. Shadow represents disease of middle lobe with involvement of adjacent part of upper and lower lobes.

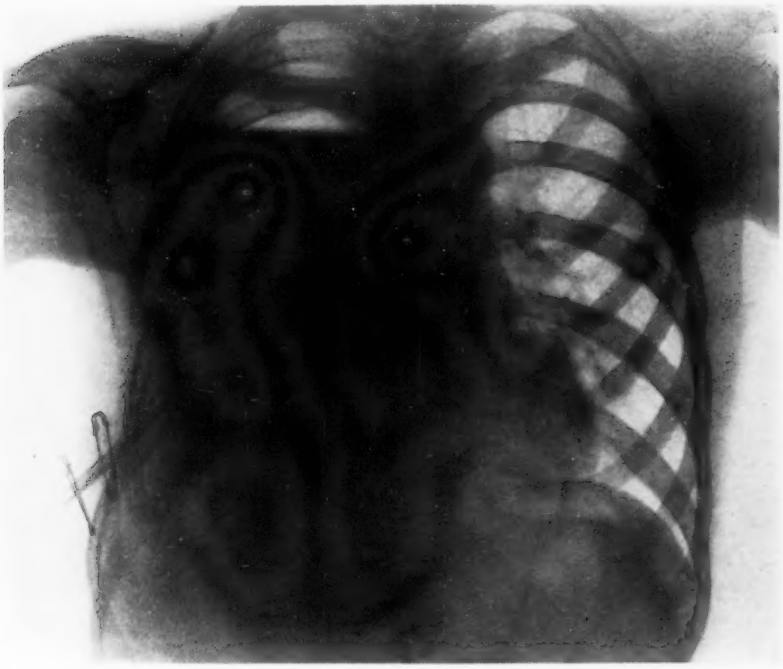


FIG. 6.—Case III. David J., post-operative sacculated empyema. Note fluid level with air above.

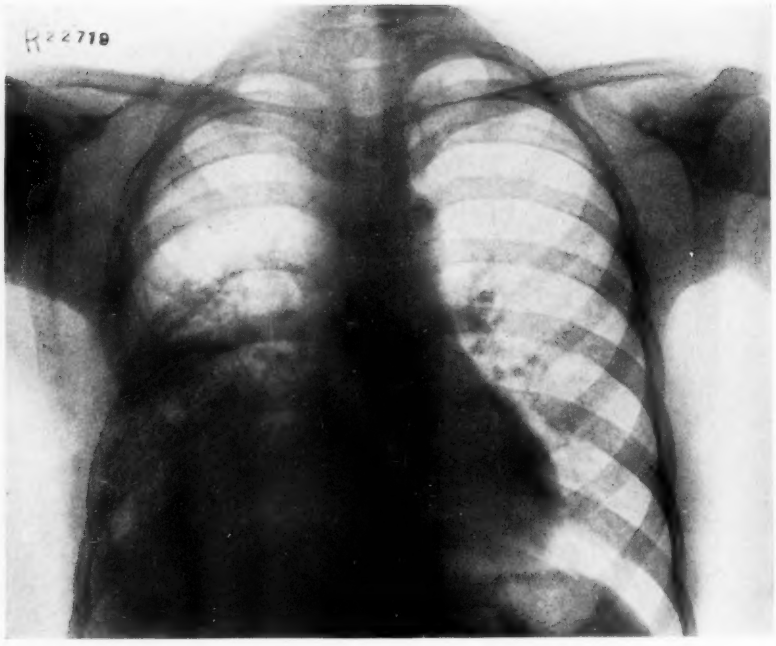


FIG. 7.—Case III. David J., ten months after operation.

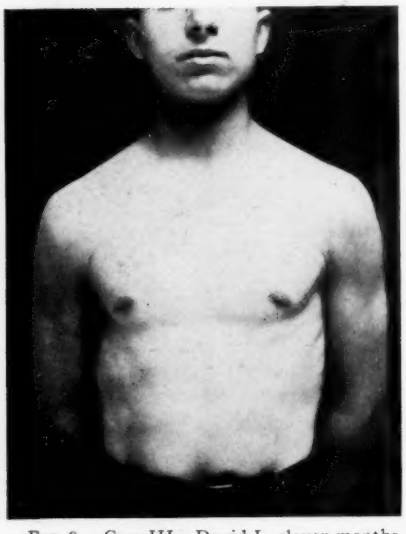


FIG. 8.—Case III. David J., eleven months after operation. Resection of middle lobe and adjacent portions of upper and lower lobes.

FIG. 9.—Case III. David J. Note physical development and good function of shoulders.

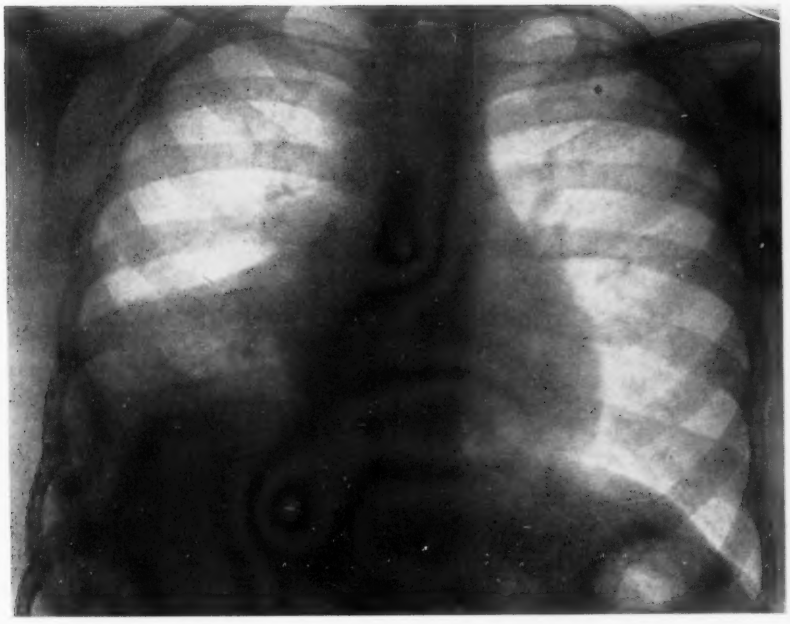


FIG. 10*a*.—Case IV. Lawrence F., before operation. Note shadow representing diseased lower lobe of right lung.

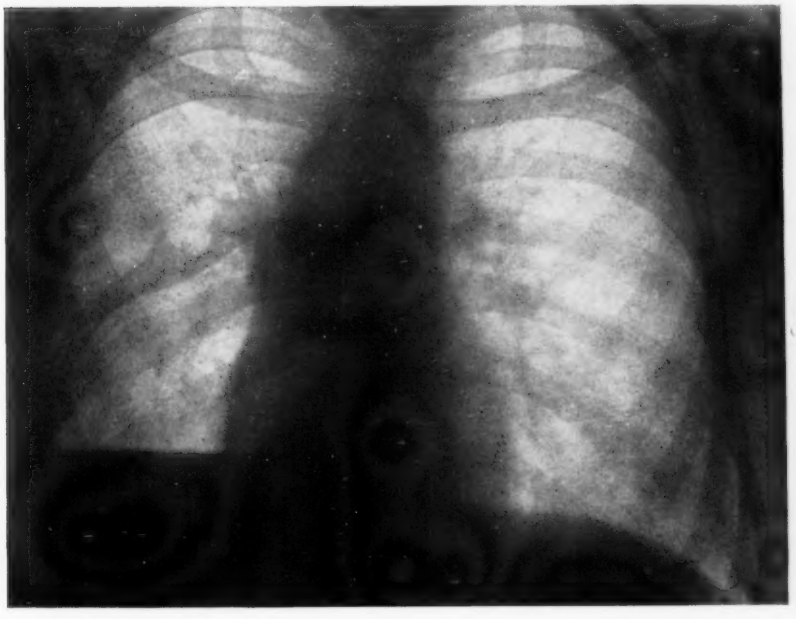


FIG. 10*b*.—Same patient as Fig. 10*a*. Eight months after lobectomy. The horizontal shadow limit represents the diaphragm in full inspiration.

FIG. 11.—Case IV. Lawrence F., after recovery. Note symmetry.

FIG. 12.—Lawrence F., illustrating perfection of shoulder function.

FIG. 13.—Case V. Mrs. B. Shadow represents bronchiectatic abscess of middle lobe.

FIG. 14.—Case V. Mrs. B., four months after extirpation of middle lobe bronchiectasis. Slight atrophy of right deltoid from disuse.

FIG. 15.—Same patient as in Fig. 14. Note extent of cicatrix. This patient could not actively raise the shoulder beyond the angle here shown. The function, however, was rapidly improving.

FIG. 16.—Case VII. Joseph S. Note shadows representing diseased right lower lobe and its adhesions to chest wall. The shadow in left chest shows some consolidation. This patient should not have been operated upon.

obviously the seat of the disease, the other two lobes being apparently normal, except for a few adhesions, and moving freely on respiration. The lower lobe, the color of liver, was of a firm consistency, and was adherent to the diaphragm and to the thoracic wall. All adhesions freed digitally, and a double ligature of chromicized catgut placed completely around the previously crushed hilum of the lower lobe. The lung was now cut away, and a slight oozing from the stump led me to transfix once more and to ligate double again. The stump was then carbolized and the thoracic cavity filled with saline solution. A piece of gauze was placed against the raw surface of the stump and led out of the posterior angle of the wound; another little piece of gauze was placed in the original sinus, the ribs approximated with chromicized catgut and one Pagenstecher suture placed so as to embrace the two ribs adjacent to the incision. At the end of the operation, which lasted a half hour, the patient's pulse was about 150, but of good quality. His color had been cyanotic during the greater part of the operation, but now became pink. In less than an hour after the operation the child was awake and crying. Hemorrhage had not been severe, and what there was came from the adhesions.

A careful examination of the lobe which had been cut away showed that all the bronchi were dilated and had turned into what might be called abscess cavities. No foreign body was found.

Twenty-four hours after the operation the temperature rose to 103 degrees and the patient looked very ill, the pulse running to 200. Skin sutures were removed because of superficial suppuration. The gauze at the posterior angle of the wound was now loosened and there was a discharge of turbid fluid, probably salt solution with pus. Tube drainage now instituted. Continuous suction apparatus used. The slough representing the hilum came away on March 16, and there was at no time a bronchial fistula. With good nursing this patient gradually improved and was discharged well on April 17. The child has remained perfectly well and has developed normally. There is no scoliosis, but perfect symmetry (see Figs. 2 and 3).

CASE II.—*Bronchiectatic Lung Abscess. Attempted Extirpation. Death.*

Jacob S., thirty-six years old, was admitted to Mt. Sinai Hospital on June 2, 1914.

Twenty-eight years before he had had pneumonia. Twelve years before his appendix had been removed. Five years before he had had malaria, and two years before he had been operated upon for right lung abscess.

The present illness consisted in pain in the right chest, copious expectoration of foul sputum, fever, night-sweats, vomiting. All

these symptoms for more than six years. Two years before he had had a thoracotomy, with removal of the sixth, seventh and eighth ribs. No relief.

Physical examination showed signs of cavity in the chest, clubbed fingers, cyanosis, rapid pulse.

Urine contained a trace of albumin and a few white blood-cells.

On admission his temperature was 101.2 degrees. Pulse, 96. Respiration, 24. The temperature depended largely upon the patient's ability to empty the abscess by coughing. At times he ejected as much as twenty ounces of sputum in a single day.

The X-ray showed an extensive involvement of the right lower lobe and a portion of the upper lobe.

On June 8, 1914, bronchoscopy was performed by Dr. Yankauer and the abscess pretty well emptied, with reduction of temperature and some subjective improvement. No foreign body was found, but the bronchi were enormously dilated.

On June 11, 1914, in intratracheal anæsthesia with ether, an attempt was made to extirpate the diseased part of the lung. Long incision in the sixth interspace, rib spreader put in. Dense adhesions everywhere, so it was with great difficulty that I finally succeeded in entering the free pleural cavity, even at this high level. The patient's condition being good and the markings between the lobes of the lung being absolutely obliterated on account of adhesions and thickened pleura, an attempt was made to isolate the diseased part by peeling it away from the parietes. This proved to be impossible, and then an attempt was made to isolate the diseased portion by means of ligation through the apparently healthy lung. During this process, however, although he had not lost much blood, and although the lung was kept well fixed to avoid fluttering of the diaphragm (which, indeed, could hardly have occurred on account of the dense adhesions), the patient suddenly collapsed and the operation had to be stopped. We had taken the precaution to segregate the blood in the patient's lower extremities by means of elastic ligatures about the upper part of the thighs. These were at once hastily cut away, letting the blood in from the legs, and the patient also received twenty ounces of saline solution intravenously, with a few drops of adrenalin. He revived, the pulse improved, and he was able to respond to questions. About an hour and a half after the operation, however, he died.

I think it is quite possible that oozing from the abscess cavity, which had been entered during the operation, was instrumental in his final taking off. I was at work over another patient when word came that this patient was bleeding. My house surgeon at

once reopened the wound and packed the abscess cavity from which he stated the bleeding came.

This case suggests the importance of recognizing an inoperable case after the chest is opened. Had we then satisfied ourselves with rib resection directly over the abscess, with evacuation and packing of the cavity, the operative death might perhaps have been avoided, though the patient would not have been cured.

CASE III.—*Bronchiectatic Lung Abscess. Resection of Right Middle Lobe and Part of Two Adjoining Lobes. Cure.*

David J., sixteen years old, was admitted to the medical service of Dr. Manges, at Sinai Hospital, on December 2, 1914.

Six months before admission he began to cough and expectorate. The cough and quantity of sputum gradually increased until large amounts of greenish and sometimes blood-streaked mucopus were expelled. He usually emptied his suppurating focus in the morning. There was pain in the right chest. A loss of fifteen pounds in weight.

Physical examination showed on the right side anteriorly from the first to the third space, dulness, and below, flatness. Bronchial breathing over the dull area and still more marked over the flat area. Vague egophony over the flat area. Posteriorly right, flatness from the angle of the scapula to the base.

Urine was normal. Wassermann examination of the blood, negative. White blood-cells showed 19,400 leucocytes, with 84 per cent. of polymorphonuclears. No tubercle bacilli in the sputum.

A difference in the two pulses showed in the blood-pressure, which was: Systolic, 100; diastolic, 40 on the right side, the left being ten points higher.

Bronchoscopy by Dr. Yankauer, on December 15. A dilated secondary bronchus was found on the right side from the middle lobe, but a lower branch also discharged pus and showed a grayish exudate.

Radiographically there was a dense shadow the size of an adult palm, roughly longitudinal, in the line of the interlobar fissure (Fig. 5).

Diagnosis before operation, bronchiectatic abscess, probably secondary to interlobar empyema.

Operation on December 28, 1914. Intratracheal ether anæsthesia by Dr. Branower. The patient had been instructed to empty his cavity before the operation. Incision was made in the sixth interspace for about nine inches, pulling the scapula out of the way by raising the arm. The entire chest was filled with adhesions so that, although anatomically within the pleural cavity, a free space existed nowhere. The fissure was easily found, and following this anteriorly the bronchiectasis was discovered densely

adherent to the chest wall and involving the posterior part of the middle lobe, while there was a considerable cavity in the contiguous upper lobe and in the lower lobe as well. It was possible to separate the posterior part of the middle lobe, and after crushing with a clamp through healthy tissue firm ligatures of chromicized catgut were put in and the portion of lobe cut away. The indurated tissues in the upper and lower lobe were surrounded by transfixion ligatures of catgut and firmly tied so as to produce strangulation, with subsequent sloughing off. A piece of the seventh rib was now resected for drainage and the entire cavity, which was fully as large as a duck's egg, was packed with gauze. This would make the total amount of lung resected very much larger than the cavity, for I did not cut away the portions of the upper and lower lobes which were diseased, but, as just stated, expected them to necrose and be cast off At the close of the operation there was some discharge of pus and bloody fluid from the mouth. The patient stood the operation well but his convalescence was stormy. The amount of sputum was immediately checked, so that there was between one and two ounces in twenty-four hours. Naturally, infection of the wound. A note on January 22, about a month after the operation, states that the patient was up and about. The respiration still somewhat rapid. Cough slight. Expectoration almost absent. Wound still discharging.

Although the patient was able to be up, his rapid respiration and slightly elevated temperature called for another radiographic examination, and this showed to the right of the sternum and next to the heart a considerable cavity, containing fluid and air (see Fig. 6). On February 1, aspiration was performed through the fifth interspace, well to the right of the sternum, with local anæsthesia, with the idea of emptying the cavity of fluid. The needle, however, entered the original surgical wound and, causing some hemorrhage, irritated the bronchial opening within the wound, so that there was hæmoptysis and distress, lasting for several minutes. There was a bronchial opening deep within the wound and the irritating wound discharges caused an annoying cough. This was kept in check by applications of novocaine to the bronchus through the wound. The collection of pus shown in the radiograph was finally evacuated a few days later through the upper part of the wound, reached by counter-thoracotomy above the original wound. By March 15 the patient had gained weight and his color was good, but on March 19 there was a slight coughing spell, with expectoration of pink mucopus. On May 4, 1915, he was discharged in good condition, the wound soundly healed. Very slight cough. Very little expectora-

tion. At the present writing he is apparently perfectly well and is working at his occupation of shipping clerk.*

Pathological report by Dr. Mendlebaum was, "Consolidation from chronic and acute inflammation. Small abscesses."

CASE IV.—*Chronic Indurative Pneumonia with Beginning Bronchiectasis and Miliary Abscesses in Right Lower Lobe. Extirpation. Cure.*

Lawrence F., eight years old, was admitted to the Children's Service of Dr. Koplik, at Mt. Sinai Hospital, on February 27, 1915. Seven months before he had had pneumonia and a little later an exacerbation which lasted two weeks. Since then cough had persisted. Four days before admission the patient had fever, the cough became worse and there was occasional vomiting. The child had gained weight during the past seven months and on admission was in good nutritional condition. Respirations were from 32 to 64. The pulse from 100 to 144. The temperature 100 degrees to 104.8 degrees. The weight 70 pounds.

Without going into details, the case suggested one of empyema, and aspiration was said to have yielded half a drachm of pus.

A radiograph of the patient's chest showed a condition almost exactly the same as that shown in Case I. The diagnosis was made of chronic infiltrated condition of the right lower lobe on examination of the plates by Dr. Jaches, Dr. Wessler and myself (Fig. 10).

The Von Pirquet examination was negative.

Blood count, 24,000 white cells; 95 per cent. polymorphonuclears; 5 per cent. lymphocytes.

On March 3 another aspiration was performed, but nothing obtained.

The urine showed some albumin with an occasional hyalin cast and a few white blood-cells.

The boy had a pasty and septic appearance in spite of his good nutrition. Expectoration and cough were slight.

On the history and appearance of the X-ray a diagnosis of bronchiectasis of the right lower lobe was made, although it was recognized that the actual bronchiectatic condition might not be fully developed, thus accounting for the slight degree of cough and expectoration. The patient was then transferred to the writer's Surgical Service and operated upon on March 4, 1915, in intratracheal anæsthesia with ether administered by Dr. Branower. The usual long seventh interspace incision was made and it was at

* April 29, 1916: The boy felt so well that against advice he played base-ball, and developed an abscess in the scar communicating with the chest. This is now almost healed, but the patient is in the hospital.

once seen that the two upper lobes of the lung were absolutely normal and without adhesions, except as stated below. The lower lobe was almost liver-colored, quite solid, and slightly adherent posteriorly to the upper lobe. Some of the adhesions were separated bluntly and others required ligation and division. Transfixion ligatures of chromicized catgut were now placed in succession through the tough adherent and infiltrated structures at the hilum, eventually forming a pedicle about the size of a silver quarter. After each ligature had been put in and thoroughly secured, distal section was made with scissors, until the last one was tied, when the entire lower lobe was cut away and removed. The lower branch of the right bronchus and one tributary were isolated, crushed and ligated separately, the stumps being carbolized. The general stump was also carbolized and the ligatures were left long. All were held together with another ligature and carried to the outside of the chest and fastened there. About a drachm of thick pus escaped when the lung was cut away. A small packing placed over the stump led out of the posterior angle of the wound, where room was made for drainage by removing a small section of the eighth rib. A tube was inserted alongside of the ligature and packing, because much secretion was expected. The remainder of the wound was closed with three pericostal sutures of chromicized catgut, a few muscular sutures and silk for the skin. Operation well borne. Very little hemorrhage. Pulse on leaving table was 140. Color, pink and good. Neither pus nor blood had appeared at the mouth during the operation. Soon afterward, however, there were symptoms of profound opium poisoning, with about ten respirations per minute. Dr. Branower made intrapharyngeal insufflation with air and oxygen and the patient received a three-hundredth of a grain of atropine hypodermatically. He at once revived and the respirations rose to 36. It was found that, through an error, a fifth of a grain of morphine had been given instead of a tenth of a grain, as ordered.

The day after the operation the respirations were 60. Pulse 148, but this patient at no time appeared to be dangerously ill. Morphine in tenth-of-a-grain doses was used regularly to hold down the respirations.

On section the pulmonary lobe was found studded with grayish nodules, large and miliary. The gross appearance of the specimen appeared like one of bronchiectasis. The final pathological diagnosis by Dr. Mandlebaum was "Consolidation of lung with purulent infiltration, miliary abscesses, slight dilatation of the larger bronchi, which contained purulent exudate."

During convalescence this boy developed a bronchial fistula at

the site of the stump. It closed, however, spontaneously. He was discharged well on May 18, 1915. Weight, sixty-three and one-half pounds. He has remained well to the present writing (see Figs. 11 and 12). Note also Figs. 10*a* and 10*b*, the radiograph before operation and after recovery. The horizontal line which looks almost like a fluid level is the diaphragm on full inspiration.

After discharge an irritating cough began, and this yielded only to tonsillectomy, which was done by Dr. Yankauer, in anæsthesia, with every precaution to prevent aspiration. Patient now *well.*

CASE V.—*Bronchiectasis Following Tonsillectomy. Resection of Middle Lobe of Lung. Cure.*

Mrs. Elizabeth M. B., about forty years of age, patient of Dr. Charles H. Richardson, had been operated upon (tonsillectomy in general anæsthesia) twenty-two months before I saw her. For years she had been a sufferer from tonsillitis with recurring quinsy. About ten days after the tonsillectomy there began the train of symptoms for which she sought relief. There was cough, with increasingly copious and putrid expectoration, characteristic attacks of fever, clubbing of the finger-tips, but with preservation of the body fat. The patient stated that she had occasionally brought up as much as a quart of stinking secretion in twenty-four hours. Possibly this was exaggerated, but from observations in the hospital it was believed that the total amount exceeded 500 c.c. There were the usual signs of cavity formation in the right lower chest. Left lung apparently normal. Repeated examinations had failed to show tubercle bacilli, except on one occasion, when eleven bacilli were said to have been found. This observation was probably erroneous.

On October 15, 1915, she entered the private ward at Mt. Sinai Hospital, where other examinations for tubercle bacilli were made but none were found. Bronchoscopy was omitted in this case because of the nervousness of the patient, which would probably have necessitated a general anæsthesia.

Dr. Wessler, of the Röntgenological Department of Mt. Sinai Hospital, reported that in the right lung, corresponding in position to the middle lobe, there was a dense, irregular, triangular shadow, with its apex situated at the right hilum and extending upward toward the axilla. The shadow extended vertically a distance of about two intercostal spaces and was well marked from the normal lung. On the oblique view of this shadow there was seen at its centre an irregular, lighter area, which was probably a cavity. The right diaphragm was abnormally high and did not move well on respiration. The upper mediastinum was somewhat pulled over into the right chest. Pleuro-phrenic adhesions on the right side (see Fig. 13).

The program was for intercostal exploratory thoracotomy with further procedures to be decided at time of operation.

On October 18, 1915, operation, Dr. Martin W. Ware assisting. In nitrous oxide and oxygen anæsthesia, preceded by a little ether (Dr. Branower), a long incision was made in the seventh interspace. Adhesions between diaphragm and lower lobe were dense and were divided between ligatures. Other adhesions peeled away. Landmarks of the interlobar fissure were at first obliterated but were later made out. The lower lobe, in spite of adhesions, was for the most part healthy. The bronchiectasis, with its grayish-red color and its rigid walls, was easily demonstrated to those present at the operation. In order to gain room the seventh rib was divided close to the angle and the rib spreader now put in. It was then possible to separate the lower lobe from the posterior part of the middle lobe until the entire diseased portion of the middle lobe was mobilized Dense adhesions between the middle and upper lobes were separated and an abscess cavity was entered, with the unavoidable spilling of putrid pus. It was now seen that the upper lobe was adherent to the chest wall almost everywhere, although it was diseased only by contiguity. The bronchiectasis was extirpated by crushing the healthy lung with powerful clamps and then making chain ligatures of chromicized catgut and finally cutting away the diseased mass. An extra suture of chromicized gut was put in the stump and this was sutured to the chest wall to immobilize the mediastinum and prevent the danger of flapping, a danger which, however, in this case, would naturally be controlled by the adhesions of the upper lobe. The lower part of the mediastinum was soft and looked normal and the pulsations of the heart were clearly visible. Because of the presence of infection the costo-phrenic sinus was lightly packed with gauze. A packing of iodoformized gauze was laid against the lower surface of the upper lobe, where the bronchiectasis had been in contact. Other light packings were led out of the anterior part of the wound. The remainder of the incision was closed by through-and-through sutures of heavy silk and the skin with fine silk. No pericostal sutures. The operation lasted just short of one hour. Loss of blood trivial. Anæsthesia excellent. Patient's postoperative condition good. Pulse after operation 140. This patient had had a rapid pulse for nearly two years, running as high as 160. The patient made an almost ideal convalescence. The expectoration all but ceased immediately after the operation, the little that was being brought up being mostly saliva and clear mucus without a trace of odor. Patient was kept quiet and the respiration slow by regular doses of heroin. On November 1 most of the packings were removed

and the following day the remainder were withdrawn. There was free and foul discharge from the wound and a small bronchial fistula developed. Continuous suction apparatus kept the patient comfortable, so that only one dressing a day was required. When the wound had become a mere sinus leading to the bronchial opening, a few drops of tincture of iodine were injected, but immediately caused an attack of coughing. The wound was healed on December 10, but two days later it reopened. A 5 per cent. mixture of iodoform and vaseline was then injected and the wound once more closed. Bronchial fistula entirely obliterated. Neither coughing nor blowing caused leakage. She was discharged from the hospital on December 20, 1915. On January 6, 1916, she raised a little blood-stained mucus and on January 4 had hæmoptysis of about two ounces. With rest in bed for a few weeks she recovered completely, and is well at the present writing (see Figs. 14 and 15).

This patient was timid about using her right arm and still has difficulty in raising it above her head (Fig. 15).

The specimen examined by Dr. Mandlebaum, of the Pathological Department of Mt. Sinai Hospital, showed multiple bronchiectatic abscesses.

CASE VI.—*Chronic Lung Abscess. Extirpation of Right Lower Pulmonary Lobe. Death.*

Jacob K., fifty-three years old, a patient of Dr. George Mannheimer, of New York, was admitted to Mt. Sinai Hospital on June 16, 1915.

Temperature, 98.4 degrees. Pulse, 92. Respiration, 24.

Patient had been operated upon for cholecystitis about a year before admission and had been operated upon again on account of jaundice, in February, 1915. In March he began to cough, with foul expectoration, thick, yellowish and often blood-stained, the sputum settling into three layers. Loss of twelve pounds in three months. Anorexia. Pain on coughing.

Pallor and emaciation on examination, the skin showing pityriasis versicolor. The lungs were emphysematous except on the right side, where, from the angle of the scapula to the base and extending toward the right axilla, was flatness with occasional râles. The left sixth to seventh interspace in the axilla cracked-pot note and amphoric breathing. Clubbing of the fingers.

Urine acid; faint trace of albumin.

The X-ray showed a dense shadow, apparently an infiltration in the location of the upper part of the right lower lobe, the shadow shading off to the more healthy part of the lung.

With the diagnosis of lung abscess operation was performed on June 17, 1915, in anæsthesia, first with ether, then nitrous

oxide and oxygen by the intrapharyngeal method (Dr. Branower). Long seventh interspace incision. The posterior part of the lower lobe densely infiltrated and dark in color. The infiltration extended into the neighboring middle lobe but only to a slight degree. A few adhesions to the costal wall were cut between ligatures. The entire lower lobe was freed to the hilum; two heavy silk sutures were put in place and used as mass ligatures. In the beginning of the operation there was some blood in the expectoration which came with the initial cough when the ether mask was applied. Foul, purulent discharge also from the mouth. The pedicle having been firmly ligated, the lobe of the lung was cut away, leaving a generous stump to prevent slipping. Four bronchi were ligated separately. The entire stump was carbolized and covered with iodoformized gauze, which led out of the posterior angle of the wound. During the operation there was little bleeding and the patient was in excellent condition. There was not the slightest sign of respiratory embarrassment when the lung was removed, although no tension was made to hold the hilum steady. Unfortunately, the patient's good condition was deceiving and steps were not taken to fix the stump of the lung to the chest wall or to steady the stump of the lung by fixing the ligatures to the chest wall. The wound was closed in layers and three drainage tubes were left within the thorax posteriorly. The patient left the table in excellent condition, pulse about 100, color pink, and good hopes were entertained for his operative recovery. When he reached the ward, however, his respiration became gasping, his pulse feeble, and he died in a few moments. The writer feels quite certain that this unfortunate result was due to mediastinal flapping because the stump of the lung had not been fixed so as to support the mediastinum.

Examination of the specimen showed the greater part of the lower lobe a mass of gangrene and abscess cavities, the edge of the lung alone remaining in any sense normal. Pathological diagnosis (Mandlebaum), " Multiple lung abscesses and purulent pneumonia."

CASE VII.—*Bronchiectasis. Extirpation of Right Lower Pulmonary Lobe. Death.*

Joseph S., twenty-five years old, was admitted to Mt. Sinai Hospital on December 22, 1915.

Temperature, 96.8°. Pulse, 80. Respiration, 20.

Six years before admission he had had pneumonia and pleurisy and was in bed for six weeks. For a year following this pneumonia he was well, then in winter he began to be troubled with profuse greenish expectoration, which was worse during the day than at night. The expectoration would diminish

in summer and increase in the cold weather. For two years before admission he had been treated as if he had tuberculosis, until he came into the hands of Dr. George Mannheimer, who diagnosed the case as a bronchiectasis. During the greater part of the time there was neither fever nor other constitutional sign of sepsis.

General condition good when I first saw him. The right chest posteriorly showed dulness from the spine of the scapula to the base, with increased voice and breathing, with sibilant and sonorous râles. No tubercle bacilli in the sputum, the total amount of which was about eight ounces in twenty-four hours, foul and purulent in character.

The urine was normal.

For several years the patient had been unable to work and had become so depressed that he was willing to undergo even the most dangerous operation in the hope of obtaining relief.

The X-ray (see Fig. 16) showed a shadow occupying the position of the right lower pulmonary lobe and the presence of adhesions between the lung and chest wall, and between the lungs and diaphragm, could be made out. On the left side in the lower lobe there were a few small shadows which it was thought also represented consolidation.

On December 27, 1915, Dr. Branower administered enough ether to narcotize the patient and then continued the anæsthesia with nitrous oxide by the intrapharyngeal method. The chest was entered by a long incision in the eighth interspace and more room was obtained by dividing the eighth rib, and, finally, by removing the greater part of this rib and dividing the seventh rib, also just in front of the angle, and again near the cartilage. The rib spreader was put in and plenty of room obtained. At the first examination the case was supposed to be inoperable on account of dense, tough, fibrous adhesions all around, uniting the lobes of the lung and gluing the entire lower lobe to the chest wall and to the diaphragm. With difficulty and with great expenditure of time the adhesions were divided between ligatures until the lobe was mobilized. It was removed by crushing the pedicle with a special clamp devised by Dr. Yankauer, the blades of which were made, at my suggestion, cylindrical and smooth, so as to avoid cutting the tissues. The pedicle having been crushed to a ribbon, it was ligated with chain ligatures of chromicized catgut and the lobe removed.

On section the lobe was found infiltrated and traversed in all directions by greatly dilated bronchi.

During the operation there was a slight show of blood in the secretion from the mouth. The division of so many adhesions,

however, in spite of all precautions, meant the loss of probably eight ounces of blood. The entire right diaphragmatic surface was raw. All bleeding had apparently ceased at the end of the operation, which took nearly one hour and a half. The ribs were approximated by pericostal sutures of chromicized catgut and a good-sized suture was put through the pedicle and fastened to the chest wall.

At the end of the operation the patient's pulse was 140, but of good quality. His appearance, however, was that of shock, and he received twenty ounces of saline solution subcutaneously. Two hours later the pulse-rate had risen to 168. Respiration, 20. Slight cough, with blood-tinged sputum. At 7.30 in the evening, three and a half hours after he had left the operating table, it was necessary to give him an intravenous infusion of saline solution. At 1.30 A.M., on the 28th, he received 300 cubic centimetres of blood transfused by the citrate method. Pulse good, about 144. During the day his condition improved and we had great hopes of his recovery, but during the night he became unconscious. The right pupil became dilated, the left contracted (meningitis?). Lumbar puncture was performed and clear fluid obtained under increased pressure. The temperature rose to 107½ degrees and the pulse, which had remained good, suddenly became weaker. He died about forty hours after operation.

In this case one thinks of what might have been done and of what might have been left undone. Perhaps an attempt at a two-stage operation might have been more successful. At any rate, it would have been wise to have had a donor ready for transfusion before operation, so that in case of necessity the blood could have been put in at once. This is a precaution which I intend to take in future. Also, it might have been wise to put ligatures around the thighs before the operation to reduce the blood-pressure. The operation was, as a matter of fact, too long by about thirty minutes, although we were deceived by the patient's good condition on the table.

BIBLIOGRAPHY

[1] Garré and Quincke: Surgery of the Lung, Second Edition (Translation). William Wood & Co., N. Y.

[2] Frederick T. Lord: Diseases of the Bronchi, Lungs and Pleura. Lea & Febiger, 1915.

[3] H. Wessler: Interstate Medical Journal, January, 1916.

[4] M. Manges: American Journal of Surgery, March, 1916.

[5] Scudder: Boston Medical and Surgical Journal, October 1, 1914.

[6] Report of the January, 1916, meeting of the Surgical Section of New York Academy of Medicine, A Study of Postoperative Pneumonia. Medical Record, March 25, 1916.

[7] Lilienthal: Pulmonary Abscess and Bronchiectasis. ANN. SURG., vol. 59, 1914.
[8] Lilienthal: The First Case of Thoracotomy, etc. ANN. SURG., vol. 52, 1910.
[9] Meyer, Willy: On Bronchiectasis. ANN. SURG., vol. 60, 1914.
[10] Bayer, C.: Zur Pneumopexie. Zent. f. Chir., 1897, Bd. 1, pp. 37.
[11] Barker, Llewellys: Syphilis and Internal Medicine. New York Medical Journal, February 26, 1916.
[12] Lenhartz, H.: In Penzoldt and Stinzing's Handbuch der gesamten Therapie, Fünfter Abtheilung, Gustav Fischer, Jena, 1910.

NOTE.—Many references to the literature of this subject may be found in publications 1, 2, and 12 of the above list.

CHRONIC NON-TUBERCULOUS PULMONARY SUPPURATION. CASES OF EXTIRPATION OR ATTEMPTED EXTIRPATION OF LESION

No.	Initials	Sex	Age	Probable etiology	Location of lesion	Date of operation	Anæsthesia	Character of operation	Result	Bronchoscopy	Remarks
I	F. W.....	M	3¼	Aspiration of foreign body	Right lower lobe	Feb. 27, 1914	Ether intrapharyngeal	Extirpation of entire lobe	Well	Yes	No bronchial leak after operation. Tachycardia.
II	J. S.....	M	36	Unknown....	Right lower and part of upper	June 11 1914	Ether intratracheal	Attempted resection	Dead	Yes	Operation abandoned before mobilization of diseased lung. Cause of death hemorrhage.
III	D. J.....	M	16	Unknown (pneumonia?)	Middle lobe	Dec. 28, 1914	Ether intratracheal	Resection of upper, lower and middle lobe	Well	Yes	Disease in middle lobe with extension into upper and lower lobes. Secondary local empyema. Temporary bronchial leak.
IV	L. F.....	M	8	Pneumonia...	Right lower lobe	March 4, 1915	Ether intratracheal	Extirpation of entire lobe	Well	No	Bronchoscopy omitted. Should have been done though no harm came from its omission. Temporary bronchial leak.
V	E. M. B..	F	40	Aspiration during tonsillectomy	Middle lobe	Oct. 18, 1915	Ether, then gas and oxygen. Intrapharyngeal	Resection.....	Well	No	Temporary bronchial leak. Postoperative hæmoptysis. Is now well.
VI	J. K.....	M	53	Exploratory laparotomy (aspiration)	Right lower lobe	June 17, 1915	Ether, gas and oxygen, intrapharyngeal	Extirpation of lobe	Dead	Yes	Death probably due to mediastinal flapping. Fixation of stump was omitted.
VII	J. S.....	M	25	Pneumonia...	Right lower lobe	Dec. 27, 1915	Ether, gas and oxygen, intrapharyngeal	Extirpation of lobe	Dead	Yes	Sepsis. (Lived 48 hours.)

Cases of Chronic Non-tuberculous Pulmonary Suppuration Treated by Palliative Operations

The first six cases have already been reported (Ann. Surg., Vol. 59, 1914)

No.	Name	Sex	Age	Disease	Date of operation	Anæsthesia	Type of operation	Results			Remarks
								Cured	Improved	Died	
1	Barney F.	M	55	Bronchiectasis	Feb. 21, 1910	Intratracheal ether	Exploration	..	..	1	Died one year later of pulmonary hemorrhage.
2	Isidor B.	M	19	Bronchiectasis	(1) Aug. 17, 1911 (2) Apr. 12, 1912	Inhalation ether Insufflation ether	Thoracoplasty Thoracoplasty	.. ..	.. ..	.. 1	The other lung became acutely infected.
3	Geo. R.	M	30	Bronchiectasis	Feb. 16, 1912	Intratracheal ether	Thoracoplasty	..	1	..	Seen a year later. About as bad as ever. Refused further operation.
4	Harry L.	M	41	Chronic abscess with development of putrid abscess (acute)	Mar. 29, 1912	Intratracheal ether	Thoracotomy and drainage	..	..	1	Died four days after operation. Pneumonia and sepsis. Tuberculosis. Error of irrigating the abscess at time of operation may have been to blame.
5	Victor H.	M	12	Chronic abscess at apex	Jan. 12, 1913	Inhalation ether	Thoracotomy and drainage	1	..	..	Through drainage, supraspinous region to infraclavicular region.
6	Antonia S.	F	26	Bronchiectasis	May 26, 1913	Insufflation ether	Thoracoplasty and drainage	..	1	..	Permanent bronchial fistulæ (present before operation and not cured).
7	Harry G.	M	24	Bronchiectasis	(1) Dec. 20, 1912 (2) Nov. 21, 1913 (3) Nov. 9, 1914	Intratracheal ether Inhalation ether Intratracheal ether	Thoracoplasty and drainage Thoracoplasty (large) Attempted ligation of branch of pulmonary artery through mediastinum	.. .. ..	1 1 ..	 1	Operation (transsternal) had to be abandoned because of firm adhesions at pedicle and poor condition of patient. Died in six days of mediastinal infection.
8	Louis G.	M	33	Bronchiectasis	Mar. 11, 1914	Intratracheal ether	Thoracotomy and drainage	..	1	..	Was discharged "improved" but not well enough to work.
9	David L.	M	49	Bronchiectatic abscess with perforation into pleura	June 20, 1914	Nitrous oxide and oxygen inhalation	Long intercostal thoracotomy and drainage	..	1	..	
10	Minnie K.	F	29	Bronchiectasis	Aug. 23, 1915	Nitrous oxide and oxygen inhalation	Thoracotomy and drainage (rib resection)	..	..	1	Other lung became involved. Death from hæmoptysis and hemorrhage from wound November 3, 1915.
11	James S.	M	53	Bronchiectatic abscess	Oct. 22, 1915	Nitrous oxide and oxygen inhalation	Large thoracotomy, drainage 5 days later with cautery	..	..	1	October 31, 1915, died in a few minutes of severe hemorrhage at a dressing.
12	Louis H.	M	44	Bronchiectatic abscess with perforation into pleura	(1) Nov. 3, 1915 (2) Nov. 27, 1915	Nitrous oxide and oxygen inhalation Local (novocaine)	Thoracotomy and resection 6 inches rib with periosteum Phrenicotomy	..	1	..	Patient greatly relieved. Permanent opening intended. Old luetic history.

THE HANDLING OF CHILDREN WITH TUBERCULOSIS OF THE SPINE WHILE THEY ARE UNDER THE INFLUENCE OF AN ANÆSTHETIC *

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It is possible that we have not heretofore given enough consideration to the fact that a child suffering with tuberculosis of the spine, and while conscious and in full control of its voluntary muscles, is a very different object from the one which lies unconscious and relaxed under an anæsthetic.

The spinal column is deeply imbedded in and supported by the intrinsic and extrinsic muscles, and these, being under voluntary control, can instantly change the spine from a pliable and yielding column into a firm and unyielding one. This power of voluntary control and self-protection is, of course, entirely lost under an anæsthetic. Likewise, the reflex muscle spasm is also lost. It is, however, the voluntary control, and the loss of it, which is the important feature.

Therefore, the spine of a child who is conscious and in full voluntary control of his movements might be compared to a watch-chain imbedded in paraffin. Under these circumstances the watch-chain could be lifted by both ends without its sagging, or one end can be rotated between thumb and finger, and the whole chain rotates in corresponding fashion. But if the paraffin is melted, the chain once more becomes limp and sagging, link moves in link, torsion at one end is gradually communicated from one link to the next until the limit of motion is reached, and so on throughout the length of the chain until perhaps one end has been rotated several times.

And so when handling a normal child we find the same condition. We lift the child in our arms and he naturally and instinctively makes a bridge of his backbone across our supporting arms. And the same is true of torsion of the spine—he instinctively resists it.

If this is true of a normal child, it is even more marked in one whose spine is diseased. Here all the elements of self-protection and guarding against injury are amplified, the child's nervous system is hypersensitive, and carefully but positively does he voluntarily protect his weakened and tender spine when he is lifted or turned over.

* Read before the Philadelphia Academy of Surgery, March 6, 1916.

Under the relaxing effect of ether anæsthesia this power of self-protection is lost and the spine sags and bends when the child is lifted, and torsion at one end of the spinal column is carried segment by segment the length of the spine, one vertebra rotating on the next one, to the limit of motion, and so on down. So we have the analogy to the watch-chain.

Now let us imagine that we have removed the spine from a child suffering with Pott's disease, and as we hold it in our hands we examine it. What do we find? Here is one with a rather sharp, angular kyphosis at the tenth dorsal vertebra. The body of the tenth dorsal has entirely disappeared, the anterior edge of the body of the ninth is resting upon the anterior edge of the body of the eleventh and in the triangular space thus formed by the bones is the soft cheesy material—the tubercular débris of the disease—and it is also under tension, for the periosseous and periarticular structures are bulging at the sides and may at any moment give way. For the retaining walls are rotted through and through, they are weak and friable, and serve only as a feeble barrier to protect the surrounding tissues. But the plastic exudate and organized lymph are doing what they can to reinforce the protecting wall. The age of this child may be perhaps three or four years.

Let us take up another specimen—the spine of a child about ten or eleven. Here a different condition prevails. There is rather an obtuse kyphosis in the lower dorsal region, involving the ninth, tenth and eleventh vertebræ. The body of the tenth has entirely disappeared, the intervertebral cartilages have been absorbed, the disease has been making inroads into the inferior portion of the body of the ninth and the superior portion of the body of the eleventh, but these two bodies are not resting the one upon the other, as in the previous case, but are separated by a considerable space. This space is filled completely with the soft mass of tubercular material, and as it is under some tension, it has forced its way into the spinal canal, entirely surrounding the spinal cord, and yet is held in restraint by a limiting wall of plastic exudate, which prevents its free escape into the spinal canal. The contrast between this spine and the previous one is very striking. Why is it that in the one case bone rests upon bone, while in the other there is the wide gap between the bodies? The history tells us that this latter child was treated for many months lying supine upon a Bradford frame, and there is every evidence that the disease continued to make progress in spite of the treatment. Now if pressure be made upon the ends of this spine it easily buckles at the apex of the kyphosis; that is, it closes as a hinge would. The increased pressure upon the abscess must cause it to

rupture at its weakest point, just as the artist, pressing in the sides of his tube of paint, expels the paint upon his palette. The abscess, therefore, may be expressed into the surrounding tissues, or into the spinal canal, or even into the spinal fluid itself, thus setting free in the cellular tissues and their lymphatics, or in the spinal fluid, large quantities of toxins.

In regard to the first spine, where bone rests upon bone, very little harm would result from pressing the ends of the spine together. But by making traction upon them the opposite effect is produced. The ligamentous structures, necrotic from the disease, easily tear and give way and the spine straightens, the kyphosis opening at its apex like a hinge, and tubercular material with its toxins may be set free in the surrounding cellular tissues and taken up by the lymphatics.

There is another factor to be considered. The intimate relationship of the great, the lesser and the smallest splanchnic nerves to the thoracic vertebræ is important. When we consider the situation of the sympathetic ganglia from which these nerves arise—the intercommunication between these ganglia and the spinal nerves and the spinal cord—the fact that these sympathetic nerves lie in such close contact with the bodies of certain of the vertebræ and terminate in the solar plexus and renal plexus, and further, that the ganglia themselves are directly connected with the bodies of the vertebræ by nerve filaments which pass into the bone, then we can see what effect traumatism in this region must have upon the general condition of the patient. Stretching and tearing of these delicate nerve structures so close to the spinal axis may produce sudden and severe shock. Likewise compression or pinching of the nerve tissue may produce shock.

What is the clinical application of these facts?

CASE I.—A child of three, with a moderate angular kyphosis in the lower dorsal spine, is considered a suitable case for a bone-grafting operation. His condition remains good throughout, with very little disturbance of his pulse or breathing. When it is time to apply the plaster bandages the patient is lifted from the table by the shoulders and pelvis. His trunk sags forward into hyperextension and a perceptible change takes place in the contour of the kyphosis. It has diminished. The plaster was put on rapidly and carefully, and perhaps not more than five minutes passed until it was completed; and yet, during this interval, the child changed from a condition of safety to one of shock. The change itself came very quickly and without warning, and he gave his doctors considerable concern until reaction was finally established.

In this young patient with tender and delicate structures, weak and friable from disease, we believe there was an actual though slight giving way of the spine at the apex of the kyphosis; or in other words, it opened a little as a hinge would open. The child's temperature, which had been running close to the normal previous to the operation, reached 104° on the second day and then gradually declined, and his condition became entirely satisfactory.

CASE II.—A child of ten or eleven had had tuberculosis of the spine for several years and had not done well. Her resistance was poor. She was put to bed on a Bradford frame, with extension on her head and lower limbs. Both lower limbs were paralyzed. After a year and three months of this treatment she was still paralyzed.

Dr. Spiller then saw her in consultation with me. From every point of view the case was not promising. But we concluded that if the spine could be made rigid by bone grafting, it would give her the best chance for improvement, and we hoped that eventually the pressure on the cord might be relieved and she might regain the use of her lower limbs. We at least had hopes of seeing her up in a wheel-chair. It seemed to me that she could be carried safely through the operation. The mother was very anxious to have anything done which promised even a little improvement.

A plaster jacket was made on the day preceding the operation and cut down both sides, so that it could be quickly and easily applied the moment the operation was completed.

At the time of the operation the child was handled with the utmost care. She was lying prone upon the table, completely relaxed under the anæsthetic, and we were about to proceed with the second step of the operation—that of inserting the bone-grafts into the spinous processes—when an unforeseen thing happened. Our anæsthetizer, thinking the child was lying a little too near the head of the table, pushed her by the shoulders. Instantly the spine buckled. That is at the apex of the kyphosis it folded together like a hinge. Very carefully we straightened her out again into her former position and proceeded with the operation. In cutting longitudinally from the base of one spinous process to the base of the next one, just about at the apex of the kyphosis, some tubercular material was seen. The child was severely shocked by the time the operation was completed. She was put into the plaster jacket and back to bed. She gradually reacted and we began to feel hopeful for her recovery. The next day her temperature was 105° and our hopefulness changed to doubt. The day following her temperature reached $105\frac{3}{5}°$, and we were completely discouraged. There was no sign of pneumonia, no evidence of meningitis. The patient died on the third day.

> I must assume the responsibility for the child's death. I do not know definitely the cause of her death. It is not my purpose either to criticise or to censure. It is possible, however, that we have grown too accustomed to think of a kyphosis as a compact mass of bone.

If there is an undercurrent of truth in the points which I have endeavored to bring out, how can we guard against these accidents?

The solution seems simple enough.

On the day preceding the operation the child should be placed prone upon a muslin hammock stretched fairly taut, but sagging a little with the child's weight. The body is swathed with a layer of cotton and, if desired, the pelvis protected with a girdle of felt and likewise a strip of felt on each side of the ridge of the spine, to prevent pressure on the tips of the spinous processes. The plaster jacket is then applied and cut down each side in the midaxillary line.

At the time of the operation the child is placed supine upon the table, the front of the plaster jacket is then removed, and the anæsthetic started. (A child should never be given an anæsthetic while his thorax is completely enclosed in a plaster jacket.) A few minutes later the front of the jacket is replaced and held firmly in place by two assistants, while the child is turned over into the prone position. The back of the plaster jacket is removed, the operation performed upon the spine, a light gauze dressing put on, and the back of the jacket with its cotton replaced, fastened firmly with girdles of adhesive plaster, and the child returned to its bed.

In this way all twisting and unnecessary movements of the spine are avoided.

We have often watched two assistants—perhaps the etherizer and a nurse—turning a child over on the operating table. Almost never do they act in perfect accord. The shoulders are turned a little before the pelvis or the pelvis a little quicker than the shoulders, and consequently there is the inevitable twist or torsion of the spine. The simple measures which I have outlined will effectually guard against this.

And so I have come to believe that, first, the operation of bone-grafting upon the spine of a child is of itself accompanied by comparatively little shock.

Second, these children bear the anæsthetic surprisingly well, proof course, it is properly given; and

Third, the handling of these children with diseased spines while they are relaxed under the anæsthetic is the most vital point in the whole procedure.

THE ELEMENT OF ERROR IN ABDOMINAL DIAGNOSIS*

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A few months ago I heard a distinguished surgeon say that, had he life to live over, being fully conscious that brilliant operators are infinitely more common than great diagnosticians, he would desire to become a clinician. No more fascinating field exists in medicine than surgical diagnosis; and yet, what branch has so few masters? No less interesting are the commoner errors of surgical diagnosis, and particularly engrossing is the study of the seemingly inevitable mistakes made in the diagnostics of abdominal disease.

Absorbed with this subject, I, some time ago, at Rochester, kept record of the errors made in a series of general cases admitted to the diagnostic department of the Mayo Clinic. Eleven hundred and seventy patients were studied, about one-half of these coming to operation. With the latter group it was found at the operating table that there was a gross error in the primary diagnosis of the clinicians in 10.08 per cent. In all of these the surgical indications were correct and the patient required an operation for relief, but in the percentage stated the clinical diagnosis was wrong.

The original diagnosis, with the operative findings, in all cases in which gross errors were made were studied, but at this time only those with abdominal diseases are considered and are presented in the following table:

Gross Errors in Diagnosis Checked at Operating Room

Clinical Diagnosis.	Operative Diagnosis.
1. Perforating gastric ulcer	Chronic cholecystitis and appendicitis
2. Aortic aneurism	Ovarian cyst
3. Chronic cholecystitis	Duodenal ulcer
4. Duodenal ulcer	Chronic appendicitis
5. Duodenal ulcer	Chronic cholecystitis
6. Duodenal ulcer	Chronic appendicitis
7. Chronic appendicitis	Duodenal ulcer
8. Carcinoma of the stomach	Septic gall-bladder with stones

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Clinical Diagnosis	Operative Diagnosis
9. Duodenal ulcer	Chronic cholecystitis
10. Duodenal ulcer	Chronic appendicitis
11. Chronic appendicitis	Gall-stones
12. Pyloric ulcer	Carcinoma
13. Ovarian cyst	Hydronephrosis
14. Extension of pus pocket from perineal abscess	Pancreatic cyst
15. Chronic cholecystitis	Carcinoma of the stomach
16. Chronic appendicitis	Hydrosalpinx
17. Ovarian cyst	Fibroids
18. Hemorrhagic endometritis	Fibroids
19. Neurosis (explore) appendix?	Chronic cholecystitis with stones
20. Reflex (explore)	Gall-stones
21. Chronic appendicitis	Chronic cholecystitis
22. Functional stomach (explore)	Strawberry gall-bladder (chronic cholecystitis)
23. Duodenal ulcer	Carcinoma of stomach
24. Carcinoma of stomach	Old duodenal ulcer
25. Ovarian cyst	Hydrosalpinx
26. Pyloric obstruction (ulcer)	Chronic cholecystitis
27. Carcinoma of cæcum	Chronic appendicitis with abscess
28. Gastric ulcer	Thickened pyloric ring (congenital)
29. Fibroids	Ovarian cyst
30. Pyloric obstruction-ulcer	Syphilis of stomach
31. Intestinal obstruction; postoperative adhesions	Ring carcinoma of transverse colon

It is interesting to note that of these errors over 75 per cent. have to do with the duodenum, gall-bladder or appendix. The majority of patients with disease of one or more of these organs have an accurate diagnosis made of the condition, but, in a certain percentage, as has been shown, gall-bladder disease is mistaken for duodenal ulcer, duodenal ulcer for chronic appendicitis, chronic appendicitis for gall-stones, and so on. The close relationship existing between the gall-bladder, appendix and duodenum has long been known and Rosenow,[1] in his recent work on the elective localization of the streptococci, has added the latest data to prove the fact. Our knowledge of this and the clearer realization of the difficulties of differential diagnosis of conditions affecting these organs have rendered the spectacular McBurney's incision, with its limited exploratory field, considerably out of fashion. The list of errors presented would have been much smaller had not a straight, rectus incision been made in most of the cases. The incompleteness of an operation performed through a gridiron incision on a chronic appendix, not presenting an absolutely clear picture,

particularly in an adult, cannot be questioned. Such an operation leaves the surgeon in but a slightly better position than the gastro-enterologist who cures gastric and duodenal ulcer, and is only kept from knowing he hasn't by the thickness of the abdominal wall. The surgeon routinely following this practice has no check on his diagnosis and will have a satisfying small percentage of errors to record.

The extraordinary similarity in symptomatology often existing between chronic appendicitis and duodenal ulcer is a subject sufficiently threadbare to be omitted were it not for the fact that the point is being constantly overlooked and is a potent factor in rendering abdominal diagnosis anything but an exact science. Not uncommonly does a patient present a history of hunger pain relieved by eating or the taking of alkalies and occurring with definite periodicity with nothing to account for the syndrome but a chronic catarrhal appendicitis. And to strengthen the diagnosis of duodenal ulcer the gastro-enterologist may report a marked hyperacidity, and the röntgenologist hyperperistalsis, or other suggestive signs; and when the operation is performed the duodenum is found normal and the removal of a chronically inflamed appendix cures the patient. I have records of several such patients in whom a 90 per cent. diagnosis of duodenal ulcer was made on a clear, uninvolved, so-called text-book history, who were completely relieved by the removal of their appendices. One patient gained eighteen pounds in the first sixty days following his operation.

Of the 264 cases of gastric ulcer operatively demonstrated at the Mayo Clinic during the year 1913–14, and studied by Eusterman,[2] there was an error in the primary diagnosis in 33 per cent. though an alternative diagnosis of gastric ulcer was made in 8 per cent. In 27 per cent. of the cases of gastric ulcer the primary diagnosis was duodenal ulcer.

Of 814 cases of duodenal ulcer observed in the same period there was an error in the primary diagnosis also in 33 per cent. In 10 per cent. of the cases of duodenal ulcer the diagnosis was gastric ulcer.

"Ninety per cent. of supposed diseases of the stomach are not entities but rather groups of symptoms masquerading as diseases and named accordingly" (Mayo). To no small extent is the converse true—that a certain percentage of actual surgical conditions affecting the stomach, duodenum, appendix or gall-bladder parade a horde of incoherent, intangible, irrelevant symptoms masquerading as nothing in particular, unless it be neurosis—the diagnosis too frequently made. Thus we are sorely in need of more accurate methods of procedure in surgical diagnosis, particularly as applied to the upper abdomen. The clinical history stands first in importance, but it is frequently unreliable.

The Cammidge and other tests have become but unpleasant memories, though they had some value. Even with the assistance rendered by the test meal, gastric diagnosis is anything but positive and methods of greater precision are looked for. For several years there has loomed large on the horizon the X-ray, and now to such an extent has it come to the front that it can be said with truth that nothing in the past decade has so advanced abdominal diagnosis as has röntgenology. Fluoroscopic examination, supplemented by plate studies and, in suspected ulcer, fluoroscopic examination combined with serial plate investigations, have increased the degree of diagnostic accuracy by means of the X-ray to nearly 80 per cent. for duodenal ulcer, 90 per cent. for gastric ulcer and over 95 per cent. for gastric cancer.

The commonest errors in abdominal diagnosis are made in connection with lesions of the gall-bladder, duodenum and appendix, but in this regard, and only second in importance, are the mistakes made in rendering a pre-operative diagnosis in diseases of the urinary system. Renal and ureteral stones, often presenting symptoms simulating anything but those of the classical picture of calculi, are factors accounting for many of our diagnostic errors. Not only is the history in these cases often confusing in the extreme but the invaluable signs, fortunately present in the majority of cases, are often absent. Thus Cabot [3] shows that in a series of 150 cases of renal and ureteral calculi the urine was entirely and persistently normal in 14 per cent. and macroscopic and microscopic blood was absent in 32 per cent. Even the X-ray is useless in a certain percentage of cases of urinary calculi, failing in 10 to 15 per cent. in Cabot's [3] series and in 11 per cent. in that of Braasch.[4]

The patient with a small ureteral stone, presenting an uncertain history, with repeatedly negative urine and nothing to show on the X-ray plate, particularly if there is a large element of neurosis in the make-up, will be frequently dismissed, branded neurasthenic, or, if he has fallen into the hands of an accommodating surgeon, will be stamped neurasthenic and simultaneously his appendix will be transferred to the formalin bottle. It is in these vague cases that the cystoscope and the pyelogram are of greatest value, and failure to resort to them often results in diagnostic humiliation. Not only in the vague but occasionally in obvious cases are gross errors made. Thus, the large clinic does not exist in which, at some time or other, one of its surgeons has not cut down upon a perfectly apparent cystic gall-bladder or splenic tumor only to regret he had not a posterior incision through which to remove the hydronephrotic kidney he has brought to light.

To every clinic come a large number of patients presenting so few

definite symptoms and such a vast amount of vague, indefinite, irrelevant data as to render the making of an exact diagnosis utterly impossible. To certain of these the title of neurasthenic is applied, a term often contracted by the exasperated and irreverent examiner to "neuro."

To the conscientious diagnostician these patients are especially trying, for, though the examiner may feel from the first few minutes of the conversation that the diagnosis is obvious, he lives in constant fear that in the incoherent recital somewhere lurks a point of great significance and that the definitely neurasthenic patient's symptoms may, in a large measure, be the result of some organic, curable condition which he may completely overlook. The attempt to bring clarity out of the tale of symptoms as presented by the full-fledged neurasthenic is the most difficult thing in medicine, and there is no task in the law or ministry approaching it.

To send a patient away branded neurasthenic is often to acknowledge defeat, but to dismiss the patient with that diagnosis only to meet her on the street a month later, obviously in excellent health, is to excite wonder and amazement equalled only by the shock of hearing of her operation for duodenal ulcer, gall-stones, renal calculus or what not at the hands of a more astute brother.

The deadly boredom associated with the daily, routine examination of a large number of patients, presenting a horde of symptoms, and yet having no definite organic lesion, accounts for a certain percentage of errors in diagnosis. The effect of the neurasthenic on the examiner is, not only to make him less alert in the study of patients of this type, but to render him often casual and superficial in investigating the condition of persons who, though they have organic disease, possess also a large element of neurosis. This type of patient is likely to direct the thoughts of the diagnostician far afield by immediately entering upon an exhaustive recital of irrelevant matter.

In a group of over one thousand consecutive patients admitted to the general diagnostic department at Rochester, 17 per cent. were sent away with the lone diagnosis of neurosis—17 per cent. of defeats—and these only acknowledged after every means had been exhausted to render a more scientific decision! In this group, however, is recorded one patient as having returned for re-examination and, though the final diagnosis was 100 per cent. for neurosis and a bare 10 per cent. for chronic appendicitis, she was so clamorous for an operation that an exploration was performed on the strength of the lone 10 per cent. and was promptly relieved by the removal of her gall-bladder and the thirty

or forty stones contained therein. Such a case is an exception, however; and, although this patient had organic disease, the symptoms were unquestionably vague, and the picture was completely masked by the neurotic manifestations which, in all probability, will remain to a great extent, even now that the organic condition has been corrected. The cure of definite surgical disease in a chronic neurasthenic does not, unfortunately, always mean the cure of the neurosis.

Two other groups of cases are customarily, as with the unfortunate and ever-present neurasthenics, examined with less exact care than they deserve, and the frequent superficial study of these individual results in very materially adding to the percentage of error in general diagnosis. The patient whose condition is complicated by alcoholism or venereal disease is apt to be considered with less seriousness by some and with more or less contemptuous disdain by others, the accuracy of the final diagnosis being regulated by æsthetic rather than scientific factors. The Wassermann has gone far in revealing to us the magnitude of the rôle played by syphilis in human disease, and the liability of the diagnostician to overlook latent lues is still another factor adding to the element of diagnostic error. The most important conclusion to be drawn from recent investigations in specific disease is that it is even more prevalent than is ordinarily supposed. The demonstration that of 4000 general hospital patients routinely subjected to the Wassermann test 600 gave a complete fixation justifies such a belief.[5] Since in tabes, the one syphilitic condition with which ye are chiefly concerned in a study of errors in abdominal diagnosis, but 18 per cent. give positive Wassermann's in the blood, the necessity, in obscure abdominal cases, even with negative pupil and patella reflexes, of an examination of spinal fluid is apparent.[5] Cases of unsuspected syphilis greatly outnumber those frankly syphilitic among patients applying for treatment at a general clinic.

In the past few years several writers, among them Cabot [6] and Hall [7] in this country, and König,[8] Lomnitz [9] and others in Europe, have directed attention to operations for supposedly local abdominal disease in patients suffering with tabes dorsalis in whom no lesion was found at laparotomy. With the Wassermann reactions on the blood and spinal fluid becoming matters of routine we have learned that any imaginable combination of abdominal symptoms may be due to cerebrospinal syphilis. It is nearly fifty years since Charcot [10] wrote, "of all the visceral symptoms which may display themselves from the period of lightning pains, one which is the most remarkable and least known, if I mistake not, is that which I have proposed to designate by the name

of gastric crisis. . . . Very often its real significance remaining misunderstood, it is the occasion of grave errors in diagnosis."

Of one thousand tabetics recently studied by Nuzum,[11] 8.7 per cent. had been subject to laparotomy one or more times under a mistaken diagnosis. Gastric ulcer was the diagnosis most frequently made, and next gall-bladder disease, with the appendix a close third. In other tabetics on whom useless operations were performed the diagnosis ranged from renal calculi to ectopic gestation. Such mistakes are not made through clinical ignorance, but as the result of superficial examinations, with hurried history taking, in which significant data are overlooked. A history of vomiting, paræsthesia, rheumatism, bladder disturbances, etc., in doubtful cases, even with normal pupils, demands a cytological examination of the spinal fluid, together with a Wassermann.

In reducing the element of error in diagnosis to a minimum in a large series of cases, as is yearly examined in every great clinic, a system of efficiency in the department of clinical diagnosis must be developed to as high a degree of perfection as possible.

At the Mayo clinic the new patient is ordinarily placed in charge of one man, and as many days or weeks as he may deem necessary are devoted to the study of the case. Unlimited time and effort are given to the task. Experts in laboratory procedures, in cystoscopic examination, in röntgenology, are immediately at hand, to whom the patient is sent for special study. All data are then collected and correlated by the original examiner and the diagnosis made.

In the daily routine of clinical work, many and varied physical abnormalities in the patient, as well as significant and important evidence in the history, will be completely overlooked, even by the most painstaking examiner. This alone helps to increase the element of error not an inconsiderable degree, and, in developing our system of diagnostic efficiency, must be considered. To eliminate this more than one clinician should, after all data have been collected, re-weigh the evidence, and at Rochester this is the invariable rule. Thus, in 3 per cent. of the patients studied, was the consultant able to elicit highly important facts from the history which had been completely overlooked by the first examiner. In over 3 per cent. valuable details in the physical examination were noted by the consultant and were added to the evidence and, finally, 4.1 per cent. of the final diagnoses, as made by the original examiner, were checked up and corrected by the consultant.

The patient with vague intra-abdominal symptoms, presenting himself for the first time, will require in the neighborhood of an hour for his first examination. Thus in the clinic where the studies forming the

basis of this paper were made the examiner, working eight hours a day, will average between seven and nine cases. Let this number be increased to twelve or fourteen, and the diagnostic mistakes that would immediately appear as the result of the necessitated haste would at once be so apparent and humiliating as to cause an immediate reduction in the number of new cases daily investigated. Even with infinite care in the study, during an eight-hour day, of but seven or eight cases, significant data in the history and valuable details in the physical examination will be overlooked. An investigation of the latter question revealed that in making general physical examinations the commonest details missed ran as follows:

Small ovarian cysts and other pelvic masses.
Small adenomata of the thyroid.
Small hyperplastic thyroids in early hyperthyroidism.
Enlarged cervical, axillary and other lymphatic glands.
Pre-systolic and other valvular murmurs.
Absent knee-jerks.
Thickened seminal vesicles.
Splenic enlargements.
Epigastric masses in carcinoma of the stomach.
High rectal metastases in carcinoma of the stomach.
Eye signs (in high tabes and other cord and cerebral lesions).
Sclerotic pallor suggesting the anæmias.
Rectal and recto-sigmoid masses in carcinoma of the rectum.

Finally, and probably the most dangerous, omissions result from the failure to recognize the direct indication for some special form of study in the case. Thus a serum test, a fluoroscopic examination, a pyelogram or an examination with the proctoscope, may be all that is needed to at once brilliantly illuminate a hitherto obscure problem.

In moments of pessimism when, after the clinician has delved exhaustively in a case for days only to see the diagnosis of which he was sure proven at the operating table to be grossly wrong, is he apt to muse, that, withal, the best diagnostician is but the cleverest guesser.

Even with the immeasurable assistance rendered us by the culture tube, the Röntgen ray, the blood count and the serum reactions, the prime requisites to the making of a successful diagnostician are the same to-day as they were when the Crookes tube, the microscope and the guinea-pig were unknown to medicine. And so is the ancient statement truer than ever, that incorrect diagnoses are oftener made as the result of lack of care in the making of the examination than as a result of lack of knowledge of how that examination should be made.

REFERENCES

[1] Rosenow, E. C.: Elective Localization of the Streptococci. Jour. Amer. Med. Assn., 1915, lxv, 1687–91.

[2] Eusterman, G. B.: Essential Factors in the Diagnosis of Chronic Gastric and Duodenal Ulcer. Jour. Amer. Med. Assn., 1915, lxv, 1500–3.

[3] Cabot, H.: Stone in the Kidney and Ureter: A Critical Review of 157 Cases. Jour. Amer. Med. Assn., 1915, lxv, 1233–4.

[4] Braasch, W. F., and Moore, A. B.: Stones in the Ureter. Jour. Amer. Med. Assn., 1915, lxv, 1234–7.

[5] Walker, I. C., and Haller, D. A.: Routine Wassermann Examinations of Four Thousand Hospital Patients. Jour. Amer. Med. Assn., 1916, lxvi, 488–91.

[6] Cabot, R. C.: Differential Diagnosis. Philadelphia, W. B. Saunders Co., 1915, ii, 229–230.

[7] Hall, G. W.: Tabes and the Surgeon. Ill. Med. Jour., 1910, xviii, 527–33.

[8] König: Tabische Krisen. Deutsch. med. Wochenschr., 1911, xxxvii, 2357.

[9] Lomnitz: Gastriche Krisen als Frühsymptom der Tabes. Deutsche med. Wochnschr., 1910, xxxvi, 486. Quoted by Singer, K.: Die Krisen der Tabiker. Berl. klin. Wochenschr., 1911, xlviii, 2168.

[10] Charcot, J. M.: Lectures on Diseases of the Nervous System. Lond., New Sydenham Soc., 1881, 27.

[11] Nuzum, J. W.: Needless Surgical Operations from Failure to Recognize Tabes Dorsalis. Jour. Amer. Med. Assn., 1916, lxvi, 482–5.

SURGERY OF THE GALL-BLADDER *

WITH ESPECIAL REFERENCE TO CHANGES IN TECHNIC

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Numerous incisions have been devised through which to reach the gall-bladder. The incisions most frequently used in this country are Mayo-Robson's and Bevan's.[1] The longitudinal part of Bevan's incision is in the linea semilunaris. This is objectionable because the intercostal nerves to the rectus muscle cross the linea semilunaris and are likely to be cut, and also because at the linea semilunaris there is aponeurosis only and no muscle, and the strongest closures are made where there is both aponeurosis and muscle.

In the Mayo-Robson incision the rectus muscle is split longitudinally, which injures it and interferes with the nerve supply to the inner portion.

A few years ago one of us (Collins [2]) devised a diagonal incision for reaching the gall-bladder, which had three advantages. First, it was a non-continuous incision in that it did not give a direct opening through all the layers of the abdominal wall into the abdomen, which permitted, in closing, the strong features of a gridiron incision. Second, it did not injure the nerve and blood supply of the rectus muscle. Third, it was placed over a portion of the abdominal wall that contained both aponeurosis and muscle.

It had one disadvantage in common with Bevan's incision. It could not be extended upward or downward. If the gall-bladder was found lying above or below its usual location, or, if it was found desirable to remove the appendix, this was, at times, a disadvantage. The recent tendency in surgery has been toward general exploration of the abdomen while the incision is open, which demands larger incisions capable of extension, if necessary.

In order to remove this disadvantage, and at the same time retain the advantages, the diagonal part of the incision is now made longitudinally. This makes a non-continuous longitudinal incision, or what might also be called a "tongue-and-groove" incision. The skin, fat,

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and anterior wall of the sheath are incised longitudinally about an equal distance from the edges of the rectus muscle (Fig. 1). The inner half of the muscle is separated from its sheath, which is easily done by blunt dissection except at the lineæ transversæ, where knife or scissors will be required. The uninjured muscle is retracted to the outer side and a longitudinal incision made through the posterior wall of the sheath of the rectus and peritoneum (Fig. 2). The muscle is preserved intact with its nerve and blood supply undisturbed. This incision may be placed over any portion of either rectus muscle and may be extended in either direction if the need should arise. While this incision has been the result of a gradual development with us and has proven very useful in our work, we wish to state, in order to forestall controversy, that in looking up the literature we have found it described before.

A short muscle- and fascia-splitting incision may be made over the gall-bladder for a cholecystostomy, by making the incision diagonally from above downward and outward through the skin, fat, and anterior wall of the sheath. The rectus may be split longitudinally with forceps, or retracted outward, and the posterior wall of the sheath and peritoneum may be perforated with forceps and split (Fig. 3). The fibres of the posterior wall split easily in a diagonal direction. This has all the advantages of a strong closure in the upper abdomen that the McBurney incision has in the lower abdomen. The drainage tube may be brought through the incision or through a separate stab wound. We prefer the latter method. This incision is applicable only in patients where an incision has been made at some other location through the abdominal wall and the size, position, and condition of the gall-bladder are known. It is not large enough to permit a cholecystectomy with the latest technic. If an inflamed gall-bladder, containing stones, is found incidentally during a pelvic or other abdominal operation, the condition of the patient at the end of the operation may prohibit anything but a cholecystostomy at that time. If the gall-bladder is large enough to permit the fundus to be brought close to the abdominal wall, this short muscle- and fascia-splitting incision may be used. It will thus be seen that its use is extremely limited. This incision was described by Collins [2] in 1909 and re-described by McArthur [3] in 1915. McArthur advises incising the posterior wall of the sheath of the rectus, but this is not necessary, as its fibres are easily split.

Without entering into a discussion of the relative merits of and indications for a cholecystostomy and cholecystectomy, it may be definitely stated that at the present time cholecystectomy is the operation of choice. It is manifestly impossible to cure a chronic inflammation

in an almost closed sac by a few days' drainage through its top, and this has led to a change in the technic of a cholecystostomy.

In the early history of cholecystostomy one of the results the surgeon dreaded was a permanent fistula. This was caused, sometimes, by the practice at that time of suturing the edges of the gall-bladder to the aponeurosis which frequently permitted the fistulous tract to become lined with mucous membrane, but it was more frequently caused by an overlooked stone in the cystic duct. These errors in technic having been remedied, we no longer fear a permanent fistula. This fear of a fistula caused the surgeon at that time to desire a prompt closure of the drainage tract and led to the practice of tucking in the edges of the opening in the fundus of the gall-bladder, so that peritoneal surfaces would come in apposition when the drainage tube was removed and result in a prompt closure of the drainage tract.

We now know that whenever drainage of the gall-bladder is desirable it should be prolonged to get the best results. Therefore, the practice of tucking in the edges of the gall-bladder opening should be abandoned, as advised by Mayo.[4]

In cases where it is necessary to open the gall-bladder and drainage is not necessary, an " ideal cholecystostomy " may be done. We have had three patients in whom a single stone was found, during a pelvic operation, in a gall-bladder which had caused no symptoms, and was without evidence of chronic inflammation. In these patients the gall-bladder was opened through the short split-muscle incision, the stone removed, and the gall-bladder closed. Reports from these patients after a long period of time said they had had no trouble referable to the gall-bladder.

It is better, when possible, as has been pointed out by Judd[5] and others, to remove the gall-bladder from below upwards. In this way the cystic artery can be clamped near its origin and the hemorrhage controlled at the beginning of the removal.

One of the serious dangers of a cholecystectomy is permanent occlusion of the hepatic or common ducts by including them in a ligature or clamp and cutting off a portion of them. Kehr[6] has described various abnormalities in the location of the hepatic duct in its relation to the cystic duct, and shows that the hepatic duct is occasionally very close to the cystic duct and even at times lying below it, which demonstrates how easily this accident can happen in some cases. The only safe way to avoid this accident is to thoroughly expose the cystic duct, which will also expose the cystic artery, and do the ligation under the guidance of the eye.

FIG. 1.—Longitudinal incision through skin, fat, and anterior wall of sheath of rectus muscle.

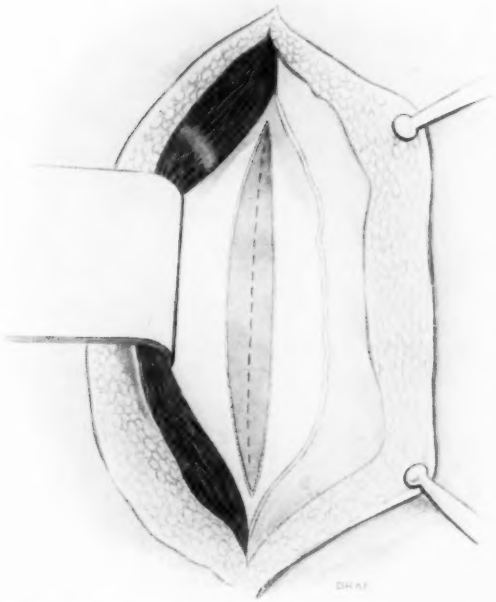

FIG. 2.—The rectus muscle is retracted outward and a longitudinal incision is made through the posterior wall of the sheath and the peritoneum.

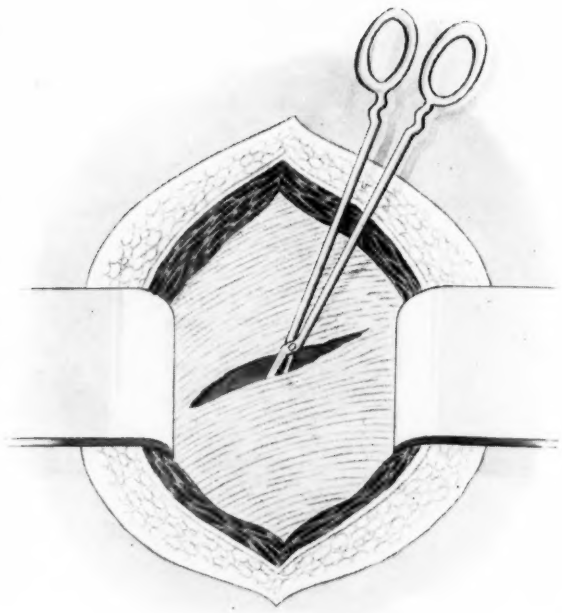

FIG. 3.—Short split muscle incision. The fibres of the posterior wall of the sheath are split by passing a forceps through them.

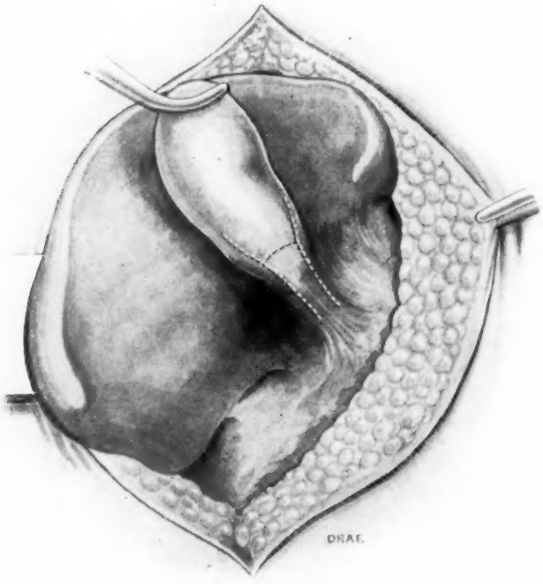

FIG. 4.—A flap of peritoneum is outlined over the lower portion of the gall-bladder and cystic duct by cutting along the direction of the dotted lines.

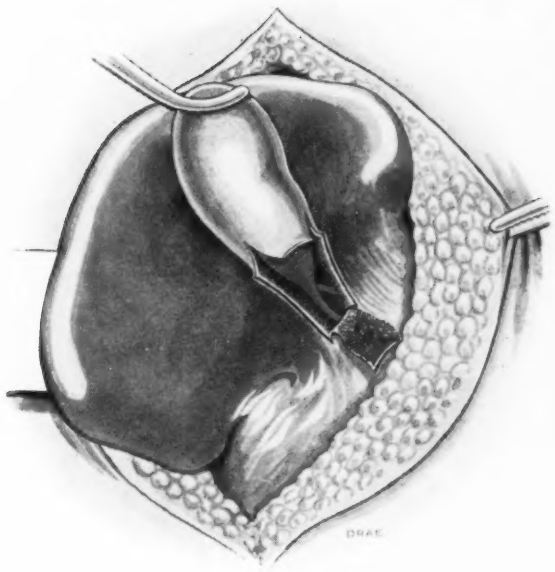

FIG. 5.—The flap of peritoneum is dissected free and turned back, exposing the cystic duct and artery.

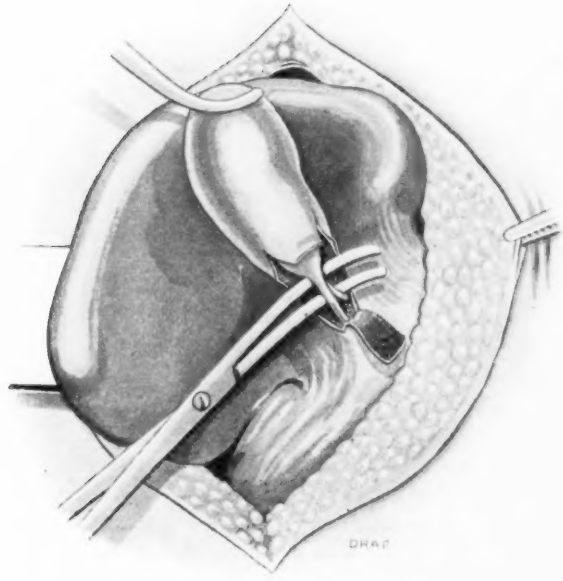

FIG. 6.—A forceps is passed beneath the exposed cystic duct and artery.

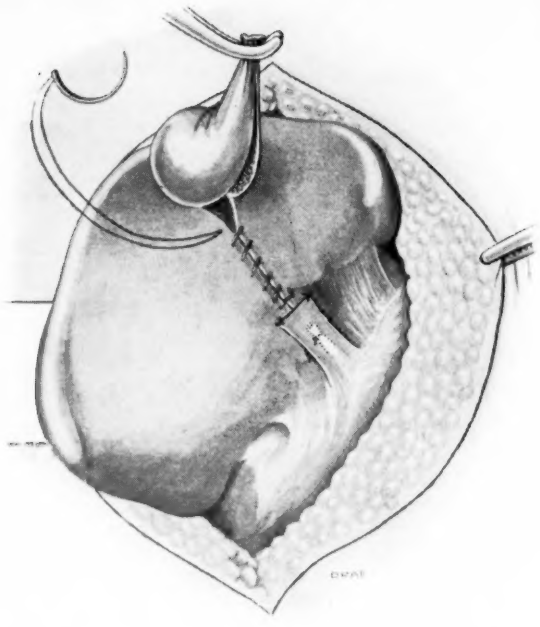

FIG. 7.—After the cystic duct and artery are clamped, cut and ligated, the flap of peritoneum is replaced over the raw surfaces and held in place by sutures.

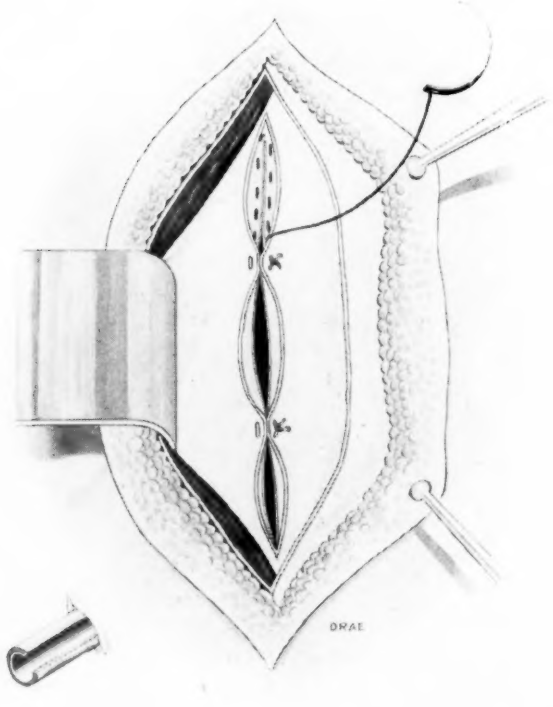

FIG. 8.—The incision in peritoneum and posterior wall of sheath is divided into three or more sections by mattress sutures, which evert the edges of the peritoneum and permit the easy closing of the peritoneal incision by a right-angled continuous suture, which leaves no raw surfaces on the under surface.

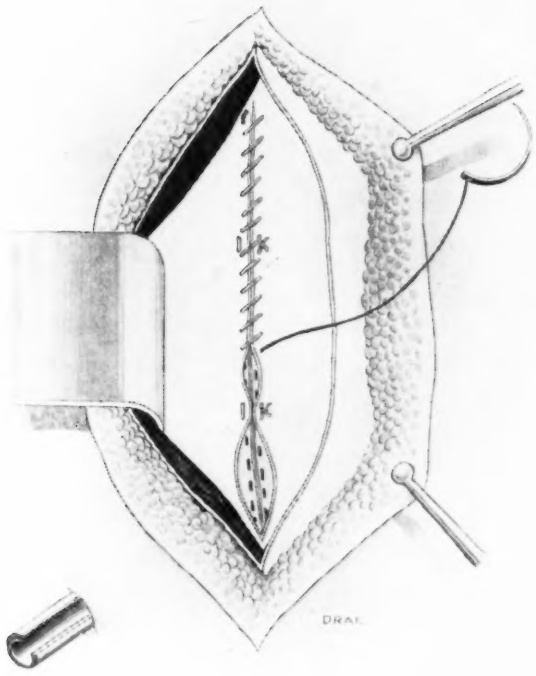

FIG. 9.—The edges of the incision in the posterior wall of the sheath are carefully approximated by a continuous suture.

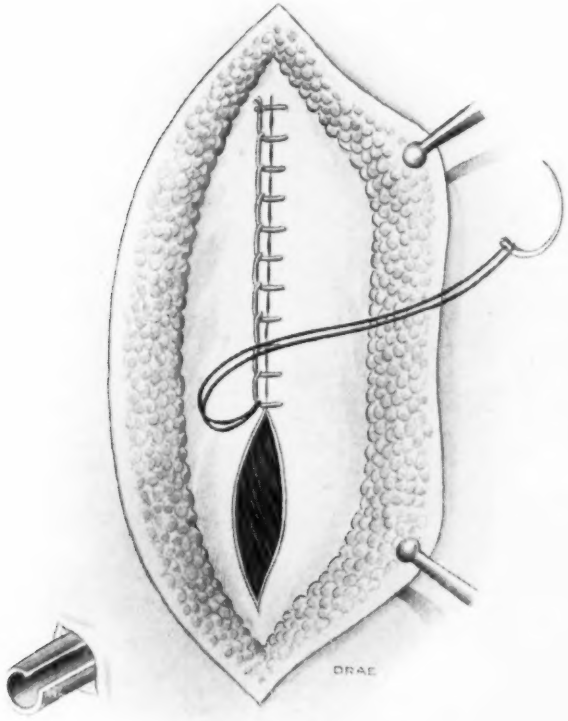

FIG. 10.—The uninjured rectus muscle which has been retracted is allowed to slip into its place and the incision in the anterior wall of its sheath is united by a continuous interlocking suture.

A large stone lodged in the lower end of the cystic duct, or partially in the cystic and common ducts, is frequently the cause of occlusion of the hepatic or common ducts during a cholecystectomy. The operator thinks the stone is lodged in the upper end of the cystic duct because the duct is large and dilated behind the stone, and places his clamp and ligature below the stone with assurance. A gradually increasing jaundice after the operation brings the horrifying evidence that the hepatic or common duct has been occluded. If the stone cannot be dislodged and pushed back into the gall-bladder, the duct had better be incised and the stone removed. Then the duct can be exposed and its relation to the surrounding tissues determined. The forceps devised by Colins [2] for removing stones from the common duct is a useful instrument for bringing an incarcerated cystic duct stone up into the incision, where it can be easily removed.

The necessity of exposing the cystic duct and artery to view before ligation and the desirability of covering the stumps with peritoneum caused one of us (Weber) to devise the following technic for doing a cholecystectomy: A rectangular flap of peritoneum is outlined and dissected off from the lower end of the gall-bladder and the cystic duct (Fig. 4). The lower end of the flap is left attached. This thoroughly exposes the cystic duct and artery and permits of their easy isolation from the surrounding tissues (Fig. 5). They can be ligated separately without danger of including the hepatic or common duct in the ligature (Fig. 6). After they are ligated and cut, the flap of peritoneum may be laid back over the stumps and sutured in place, thus leaving no raw surfaces (Fig. 7). The gall-bladder may then be removed and the fissure closed in the usual manner. The flap of peritoneum can be cut large enough to provide for any contraction. If the peritoneum is cut longitudinally over the cystic duct, the peritoneum dissected up on each side contracts so that it is frequently impossible to draw the two edges of peritoneum over the stump of the cystic duct. Frequently the peritoneum only goes one-half or two-thirds the way around the cystic duct, and this makes it difficult to dissect back a cuff sufficiently long to cover the stump of the cystic duct, as recommended by Moynihan. No such difficulties are encountered in making and replacing the peritoneal flap.

Since reading Ruth's [7] article advocating drainage in gall-bladder work through a separate small incision or stab-wound, we have followed that plan. This permits of complete closure of the large primary incision, which must have a tendency to prevent a post-operative hernia.

Probably every surgeon has had difficulty at times in closing the

peritoneum and posterior wall of the rectus sheath in a gall-bladder incision, because of retraction of the edges caused by the side pull of the external and internal oblique and transversalis muscles. It is not best to catch the edges of the peritoneum with two rows of forceps, as has been advocated by Robins,[8] because of the post-operative soreness caused by the crushing action of the forceps on the tender sensitive peritoneum. The edges may be united at two or more places with mattress sutures, which will divide the incision into three or more sections. The edges of these short sections can then be easily united with continuous sutures (Fig. 8). If forceps must be used to facilitate the placing of these mattress sutures, they should grasp the edges of the posterior wall of the sheath only, as this structure is not so sensitive as the peritoneum, which can be closed by a right-angled continuous suture, thus leaving no raw surface on the under side (Fig. 8).

The edges of the posterior wall are closed by a continuous suture, and considerable care is used in closing the edges of this layer, as we believe, with Bartlett,[9] that it is necessary in order to avoid a post-operative hernia (Fig. 9). The rectus muscle is then allowed to slide over into its place and the anterior wall of the sheath is closed with an interlocking suture (Fig. 10). It is not necessary to suture the muscle in any way. In this way the intact uninjured rectus muscle lies between the closed incisions of the anterior and posterior walls of the sheath and there is no continuous incision down through the various layers of the abdominal wall.

LITERATURE

[1] Bevan, A. D.: On the Surgical Anatomy of the Bile-ducts. ANNALS OF SURGERY, July, 1899.

[2] Collins, C. U.: Some Points in the Surgery of the Bile Tracts. Surg., Gynæc. and Obst., March, 1909.

[3] McArthur, L. L.: A Modified Incision for Approaching the Gall-bladder. Surg., Gynæc. and Obst., January, 1915.

[4] Mayo, C. H.: Cholecystitis and the Factors That Control Results of Operation. Journal—Lancet, 1914, vol. xxxiv.

[5] Judd, E. S.: The Technic of Cholecystectomy. ANNALS OF SURGERY, March, 1915.

[6] Kehr, Hans: Die Praxis der Gallenwege-Chirurgie.

[7] Ruth, C. E.: Common Errors in Gall-tract Surgery. Journal A.M.A., September 5, 1914.

[8] Robins, C. R.: Closure of Right Rectus Incision. Surg., Gynæc. and Obst., September, 1915.

[9] Bartlett, Willard: A Clinical and Experimental Study of Post-operative Ventral Hernia. Illinois Medical Journal, June, 1915.

CYSTS OF THE URACHUS

WITH REPORT OF A CASE

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The urachus, like all other fetal vestiges, lends itself to changes and disorders which not infrequently bring it to the notice of the surgeon, as well as the pathologist. This remnant of the allantois is situated preperitoneally, running from the summit of the bladder to the umbilicus, directly under the transversalis fascia. It is composed of an inner lining of stratified epithelium, and an outer fibromuscular coat. It is a rather long tubular structure, and hence it is often the seat of multiple dilations of its lumen, which may vary in size from minute to as large as a hazel-nut, but which are of no pathological significance.

Cysts of the urachus of sufficient size to be of surgical importance seem to have been recognized first in 1873, when a case was reported to Wolf. Wutz,[1] however, ten years later argued that the evidence submitted by Wolf was insufficient upon which to base a diagnosis, and that this case was likely not one of urachus cyst.

In 1898 Doran [2] reported a case of his own and appended an extensive review of the subject. He, following closely the views of Wutz, expressed serious doubts as to the correctness of the diagnosis in many of the reported cases, because of the lack of proper histological evidence to support it. He called attention to disease of the peritoneum with ascites as being a reasonable diagnosis, in a few, at least, of the cases.

In fact, the purpose of Doran's exhaustive communication seems to be to dispose the urachial origin of most of these collections of fluid, and from this it appears that the correct diagnosis of certain cases was still in doubt following operation. Even in his own case he is not positive as to the real diagnosis.

In 1906 Weiser [3] collected 86 cases from the literature and by personal communication, which he carefully tabulated as to history, symptoms, and treatment. In this series are included small unimportant cysts and tubular dilations of the urachus, many of which were dis-

covered by accident upon opening the abdomen for other reasons. The majority of his cases of surgical importance were of great size and were undiagnosed prior to operation, either due to their size, or to inflammatory change which confused the symptoms with those of general peritoneal involvement.

As to the origin of urachus cysts, many authors have called attention to a sacculated condition of this structure, due to a lengthening out in places of its attachment to the ventral wall. This, while not uncommon, however, very seldom results in the formation of a large cyst. Therefore, there must be added a patulousness of the tube where it enters the urinary bladder. According to Binnie,[4] in the process of normal obliteration of the urachus these sacculations may persist, as well as small cysts without any further significance. If, however, there remains communication with the bladder, and then there arises some interference with emptying of the bladder, a large dilatation may gradually occur. The communication with the bladder may persist, giving an intermittently appearing and disappearing tumor. Usually, however, due to pressure and the action of the urine, the opening becomes smaller and smaller, until entirely shut off and a permanent tumor is produced.

Most commonly the cyst arises in the lower one-half of the urachus. Those having umbilical communication—about 15 per cent. of Weiser's cases—arise higher up. Rarely are both ends open, although cases have been reported in which the umbilical opening developed secondarily, due to pressure and the influence of inflammatory change.

The cyst may possess a pedicle and be entirely surrounded by peritoneum, or it may be situated in close connection with the abdominal wall, only having its posterior surface covered with peritoneum. As the size increases its identity as a localized tumor is apt to be lost and the whole abdomen become filled with a fluctuating mass, making an accurate diagnosis impossible. Quite frequently the larger cysts become infected, either by extension through bladder communication, or an umbilical opening, or from hematogenous sources. In such cases the symptoms are not unlike those of general peritonitis.

The contents of the majority of cysts is usually a straw-colored or clear fluid of rather low specific gravity, with alkaline reaction. Sometimes it is distinctly urinary and may have undergone decomposition. In those where the lumen has been permanently obliterated for some time the fluid is almost colorless. The enlargement is continued by a secretion from the walls of the cyst which may have been so thinned by the pressure of distention as to have almost lost the identity of the original urachial coverings. It is for this reason that much difficulty

has been found in confirming the clinical diagnosis by histological examination.

All of the cases reported up to the present can be conveniently grouped into three classes: First, cysts of great size, which occupy considerable space in the abdominal cavity. Second, cysts in which infection of the contents had taken place with the formation of an acute abscess. Third, cysts which present as intermittently appearing and disappearing tumors, due to umbilical or bladder communication.

With the possible exception of the third class, the diagnosis before operation, and even afterward in some cases, can only be guessed, due to the generalized location of the fluid in the first class, and to the masking inflammatory symptoms in the second. It is for this reason, and also to show that not only the very large or infected cysts may bring the patient to the notice of the surgeon, that the following case seems of interest.

CASE I.—G. I., aged thirty-two; farmer; residence, Bremen, Ohio. Physician, Dr. Bradford. Presented himself early September, 1914, complaining of a dull ache in lower abdomen. Inquiry into his family, past and personal history revealed nothing unusual. His present trouble began about three months previous, when his attention was attracted to a soreness in the midline of abdomen three or four inches below the navel. Was carrying a load braced against the abdomen when he first felt the soreness. He paid no attention to this until continued distress upon pressure time after time caused him to be more or less incapacitated. Only deep and firm pressure such as would be produced by lifting heavy objects against his body annoyed him. It was at this time that he first thought he could feel a lump. Finally, in the next two months, after working steadily during that time, the pain grew worse and assumed a constant dull, aching character whether he was at work or not. Once or twice he had an acute colicky attack. The tumor after the first notice remained but increased slightly in size. To the dull, aching pain there was added a rather pronounced tenderness on any kind of pressure. He stated that a semi-stooping position when walking was the most comfortable for him. There had at no time been any discharge from the umbilicus, nor had the flow of urine ever been increased. Bowels were regular.

Physical Examination.—Patient was a fairly well nourished male of good color. All examinations except that of abdomen negative.

In the midline below the umbilicus through wall of only medium thickness could be palpated an ovoid mass about ten or

twelve centimetres in length. This almost filled the space between the symphysis and the navel. It was discrete and could be moved laterally in either direction, but always returned to its original position. It could not be moved up or down, and could only be displaced into the abdomen as the walls were pressed inward. The movement up and down seemed to be limited first by the firmness of the attachments, and second by pain caused either above or below, as the mass was moved in the opposite direction. The lateral movement gave one the impression of a swinging motion that would come from the tumor being fixed to the abdominal wall by only a part of its circumference. It seemed that a fluctuation wave could be felt, but this was not positive. The umbilicus appeared normal. Tenderness upon manipulation of the mass, while not unbearable was marked. Otherwise the abdomen was negative.

A diagnosis of "cyst of the urachus" was made, and operation advised for its removal. Under ether anæsthesia the abdomen was opened by an incision slightly to the right of the midline, in order to avoid opening into the cyst cavity should the diagnosis be correct. The peritoneum was opened, and to the left was found hanging down into the abdominal cavity a cystic tumor (Fig. 1), recognized by its transparency, covered with peritoneum and having an attachment to the ventral wall about three-quarters to one inch wide. This attachment extended throughout the entire length of the tumor.

After exposing the peritoneum on the opposite side, it was incised and freed, the portion covering the tumor being undisturbed. The cyst then occupied a position in the middle of the incision, supported by its upper and lower attachments. These, when examined closely, were found to terminate at the umbilicus and bladder, respectively. The urachus was made out above, and when followed down seemed to blend into the wall of the cyst and could be picked up again at the lower pole of the tumor. The remainder of the attachments consisted of peritoneum, preperitoneal fat and obliterated hypogastric vessels. Both ends were ligated and the cyst removed.

The abdomen was closed in the usual manner, and the patient made an uneventful recovery, leaving the hospital in two weeks.

Examination of the cyst showed it to be very thin-walled, with numerous small blood-vessels traversing its surface. Its size was 11.5 x 8 x 8 cm., and it contained about 200 c.c. of a clear, straw-colored fluid. This was of alkaline reaction and albuminous in character.

Histological study of a portion of the wall of the cyst near the one pole revealed nothing except its fibrous structure.

FIG. 1.—Cyst of the urachus, removed in Case I.

This case seems to have been a true cyst of the urachus, as its situation and its relation to this structure both above and below would hardly bespeak any other condition.

A point which must be emphasized in the treatment is extirpation *versus* incision and evacuation of the contents, with subsequent drainage. In only eight of Weiser's cases was extirpation made. This may have been due both to the great size of the cysts and the obscurity of the diagnosis. In the large cysts it is doubtful if complete removal can be successfully practiced, especially if the contents have become infected. The smaller ones, however, of which this case is an example, do certainly permit of such procedure and care in attacking such a case will greatly simplify the treatment.

REFERENCES

[1] Wutz: Virchow's Archiv, xcii, p. 387.
[2] Doran, A.: Medico-Chirurgical Transactions, vol. lxxxi, 1898.
[3] Weiser, W. R.: ANNALS OF SURGERY, vol. xliv, pp. 529–552.
[4] Binnie, J. F.: Cited by Griffith, J. F., American Practice of Surgery, vol. vii, p. 80.
[5] Baldwin, J. F.: Surgery, Gynæcology and Obstetrics, June, 1912.

A TRANSPLANTABLE CHONDRO-OSTEOSARCOMA IN A DOG

By John E. McWhorter
and
Frederick Prime, Jr.
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(From the Laboratory of Surgical Pathology, College of Physicians and Surgeons and the George Crocker Special Research Fund, F. C. Wood, M.D., Director, Columbia University)

Spontaneous neoplasms of rodents—particularly of the mouse and rat—have been successfully transferred to other animals of the same breed and are apparently capable of continuous growth for an indeterminate number of generations. Attempts to propagate tumors of other mammals have, for the most part, met with but partial success, owing to the fact that growth of the transplant usually ceases shortly after the transfer. Then regression takes place and the tumor disappears in the first or second generation.

This paper records the successful transplantation, through three generations, of a mammary chondro-osteosarcoma of a dog, in which development of bone was observed in the first generation of transplants.

Clinical History of Dog with Spontaneous Tumor.—On February 23, 1914, a dog, the property of Mr. S., was admitted to the Animal Hospital of the Department of Surgery with the following history:

Breed: Wire-haired fox terrier. Sex: Female. Age: Eleven years. Present history: Eighteen months before admission to the hospital, a small nodular mass was noticed in a mammary gland of the left lateral region. The growth had been extremely slow until a month before admission, when it had rapidly increased in size until it reached such proportions as to interfere with walking. Previous to the period of rapid growth the dog seemed well, but from then on her general condition rapidly deteriorated.

Physical Examination.—The tumor mass was irregular in outline and roughly spherical, measuring about 10 cm. in diameter; it was loosely adherent to the skin, but freely movable on the deeper structures. In the left cervical region a second tumor was found which measured about 4×3 cm., apparently it was not connected with the mammary tumor and was not observed until the period of rapid growth of the latter.

Operation.—The primary tumor was excised with aseptic precautions under cocaine anæsthesia, by Dr. St. John, on February 27, 1914. It was somewhat lobular in form, well encapsulated, and only loosely adherent to the deeper structures. No evidence of infection was present. The dog made a good recovery from the operation and was taken home five days later, but the next day it was

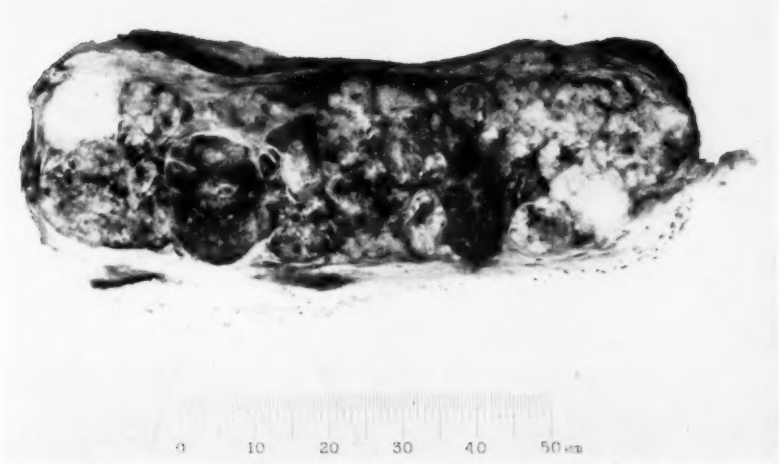


FIG. 1.—Surgical Pathology No. 2884. Gross-section of primary tumor.

FIG. 2.—Surgical Pathology No. 2884. Primary tumor showing distribution of cartilage, sarcomatous tissue and glandular structure.

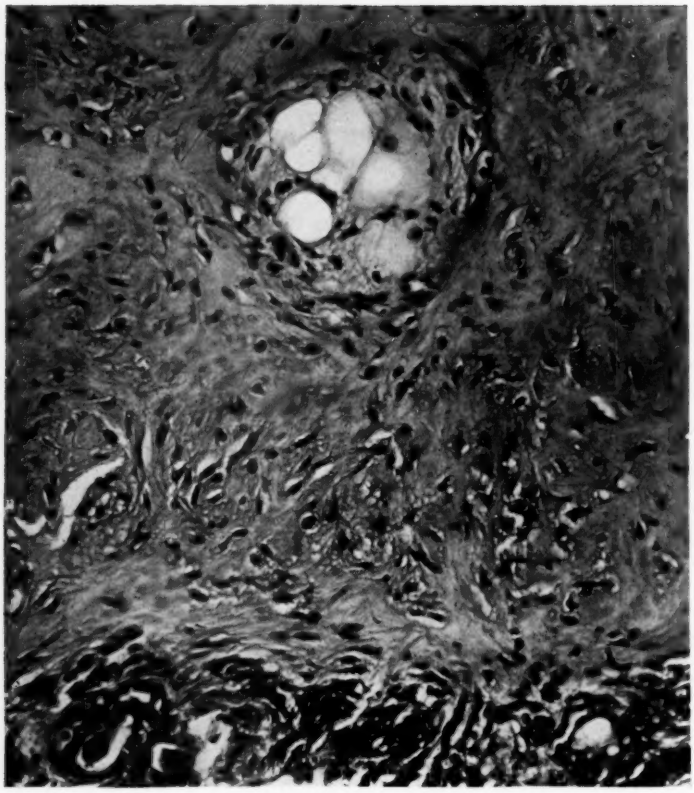


FIG. 3.—Surgical Pathology No. 2884. Primary tumor showing junction between cartilage and hyperplastic glandular tissue.

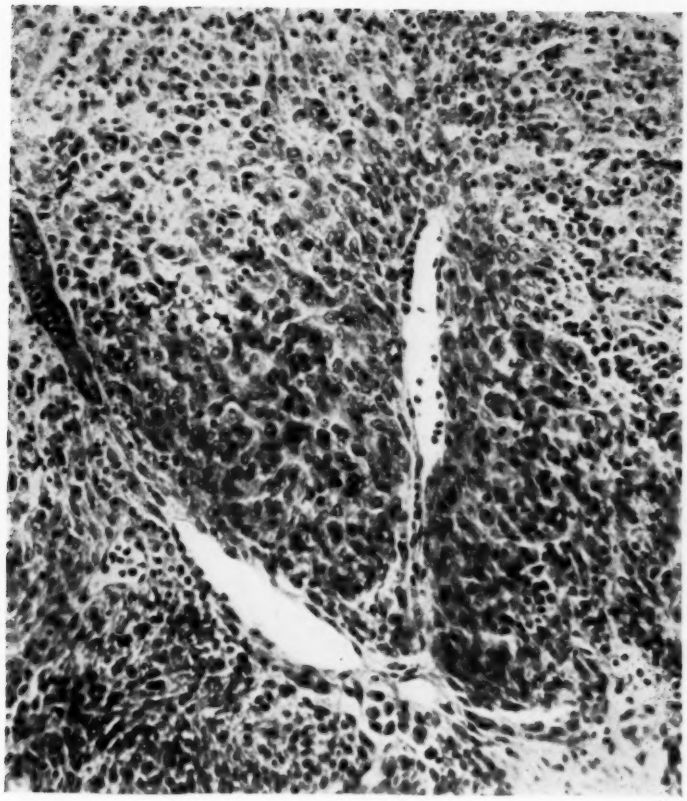


FIG. 4.—Surgical Pathology No. 2056. Tumor showing necrosis of carcinomatous tissue except in neighborhood of capillaries.

FIG. 5.—Surgical Pathology No. 2963. Section showing formation of bone in transplant.

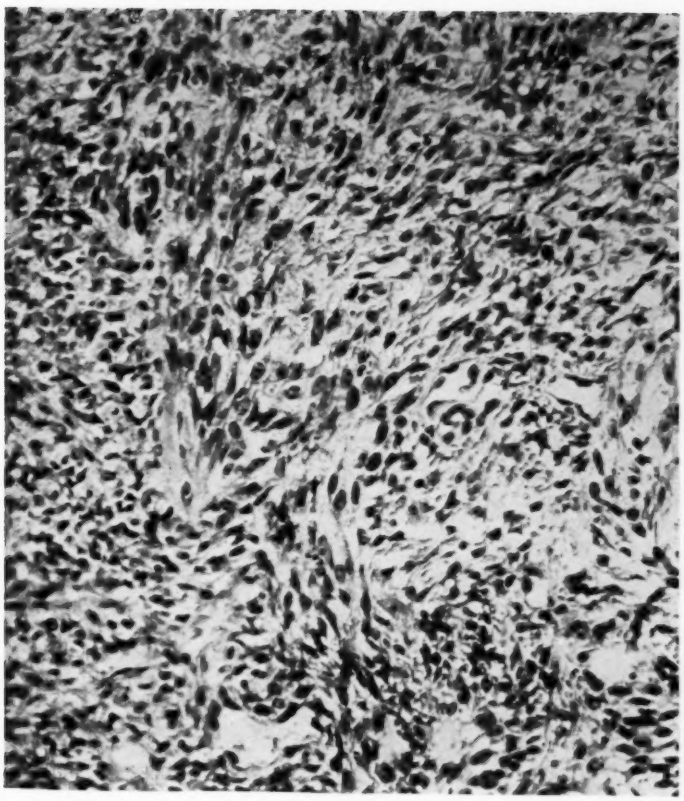


FIG. 6.—Surgical Pathology No. 2945. Section showing arrangement of connective tissue cells in transplant.

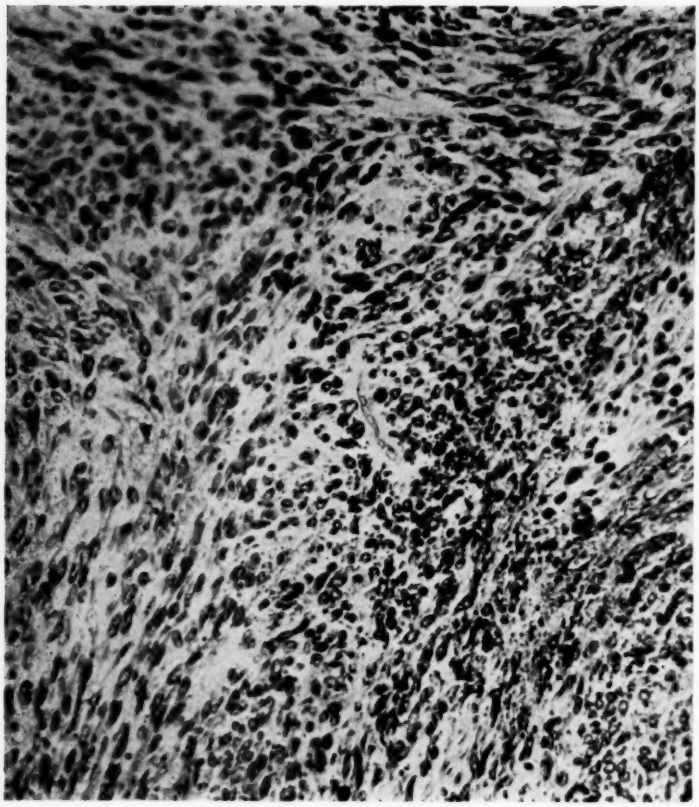


FIG. 7.—Surgical Pathology No. 2978. Section showing cellular arrangement in second generation of transplant.

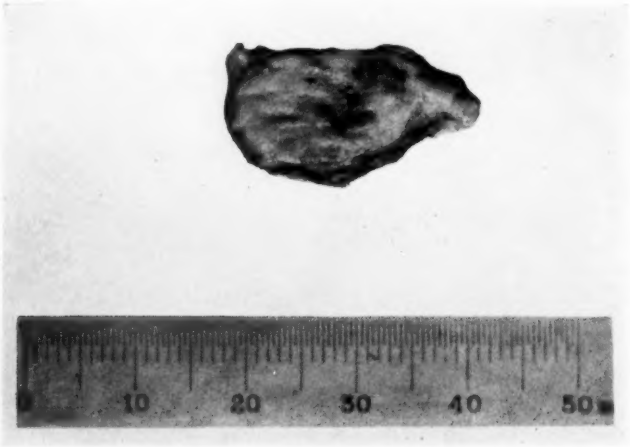


FIG. 8.—Surgical Pathology No. 3000. Gross appearance of transplant from second generation.

said that she fainted and was chloroformed by her owner. No autopsy was obtained.

Description of Primary Tumor.—Macroscopic appearance (Surgical Pathology No. 2884, Fig. 1): The specimen consists of a well-encapsulated, lobulated mass of tissue, roughly spherical in outline, measuring 9.5 × 10 cm. The capsule is rather thick and very dense. On cross-section the entire mass is firm and very dense, some areas cutting like cartilage, while others are of bony consistency. The cut surface presents a variegated appearance, suggesting that the tumor is made up of many types of tissue. Some areas show dilated spaces filled with an amorphous substance, others a mass of tissue projecting from the wall into the lumen, still other regions, because of their hard consistency and gritty feel, suggest spongy bone. Scattered here and there through the structureless tissue of the stroma are small areas which resemble cartilage in appearance and density.

Microscopic Examination (Figs. 2 and 3).—Sections show the glandular tissue in some areas to be compressed, the epithelial cells hypertrophied, and for the most part vacuolated. Many of the acini show a heaping up of these cells, with the production of a papillary outgrowth from the walls into the lumina; this cellular arrangement is orderly and shows no tendency to infiltration. In other areas the acini are widely dilated and contain an amorphous substance, staining deeply with hematoxylin. These glandular areas are generally surrounded by zones of round-cell infiltration. Extending outward beyond the mammary gland and abutting upon the lobules of the breast is a mass of dense connective tissue which becomes denser where it meets the intralobular septa. Beyond this margin the tissue is more cellular and is of a much looser structure.

These cells, for the most part spindle-shaped, are rapidly proliferating, as evidenced by their intense staining and the number of mitotic figures. This mass of connective tissue in some areas becomes less cellular and long fibrous strands project from it, interweaving with other strands, to form zones of dense fibrous tissue. The cells lying between these strands have lost their spindle shape and become stellate. This tissue gradually merges into fibrocartilage.

Other sections show the connective-tissue cells to be more rounded than oval; more of the oat than the spindle shape. In many of these areas are scattered nodules of spongy bone.

The formation of bone seems to be one of the characteristics of this tumor; it is scattered generally throughout the connective-tissue stroma; but neither the type nor the arrangement of these connective-tissue cells seems to have any definite influence on its formation. The chief elements of this neoplasm therefore are: (1) Sarcomatous tissue; (2) spongy bone; (3) cartilage.

Transplantation of Tumor.—When the tumor was excised several bits of tissue were taken at random from the mass for transplantation.

The technic of transplantations was in all cases the same. The tumor was placed in a sterile dish, and thin slices were cut through the apparently malignant portions. Fragments from these areas were cut into pieces about 0.02 Gm. in weight, and were introduced through an inoculating needle subcutaneously into the axillary regions.

The original tumor was inoculated into both axillary regions of twenty dogs, five of which were part terrier, and not of exactly the same breed as the original dog. Four of the five were puppies and were inoculated on the day of birth. One month later it was found that five of these twenty dogs had developed tumors,

two of which had been inoculated on the day of birth (cf. Chart I). Of these there were three females and one male, while in one the sex was not recorded. One dog of this group died before the tumor was removed. From a second dog, an adult female, the tumor was removed and inoculated in both axillary regions of twenty dogs. At the same time an attempt was made to grow some of this tissue in plasma, but without success. A week later the tumor in a third dog had disappeared.

The growth in one of the two puppies, however, had increased enormously, measuring 3.1 × 2.7 cm. This was removed thirty-nine days after inoculation and transplanted into both axillæ of six other dogs. The second puppy with a tumor died at the end of forty-four days, and as the tumor was decreasing somewhat in size it was not transplanted into other dogs.

In the second series of the second generation (cf. Chart II) the transplants at the end of seven days showed growth in five out of six dogs; in three of these the tumor appeared on both sides. Four of these animals were males and one was a female. These tumors were not as large as those in the previous generation, nor did they grow as rapidly. At the end of a month all but one had disappeared. One was inoculated at the end of eleven days into seven young dogs but did not proliferate in the new hosts.

The first series of the second generation of transplants (cf. Chart III), showed at the end of three weeks tumors in three female dogs out of twenty inoculated, one of which had nodules on both sides. Seven days later another dog of this series had developed a growth, and seven days after this the last tumor of this series was found in a male dog. One of the neoplasms from the dog which had developed a growth on both sides was inoculated with negative results into both axillary regions of twelve dogs. The tumor on the other side was left *in situ* and disappeared at the end of another month. Another tumor of this series which was beginning to retrogress was partially removed and inoculated without success into both axillæ of ten dogs. The portion left in the host soon disappeared.

Under the existing conditions, three months after the tumor had been removed from the original host, the tumor strain died out. During this period it was carried by transplantation through three generations.

Description of Transplanted Tumors.—Of the first generation of transplants, three tumors have been selected for description, as they fairly represent all the growths in this series. Surgical Pathology Nos. 2963 and 2956 were growths in puppies one day old, the results of transplants from the original host. These puppies, though not of the same breed as the original dog, were, however, closely related, as their mother was partly terrier.

Surgical Pathology No. 2545, a tumor growth in an adult dog, planted with the same tissue and at the same time as 2963 and 2956. This animal was not a true terrier, although it undoubtedly had some terrier blood. Tumor 2956 was removed thirty-eight days, 2963 forty-four days, and 2945 thirty-one days after transplantation.

Surgical Pathology No. 2956. Macroscopical appearance. The specimen consists of a well-encapsulated mass somewhat lobulated and oval in outline, measuring 5.5 × 3 cm. On section it is found to be made up of dense tissue that extends from the surface inwards for about 1 cm. The centre consists of a soft friable mass, probably degenerative tissue; elsewhere as the knife passes through the tumor a number of areas are encountered which have a hard gritty feel.

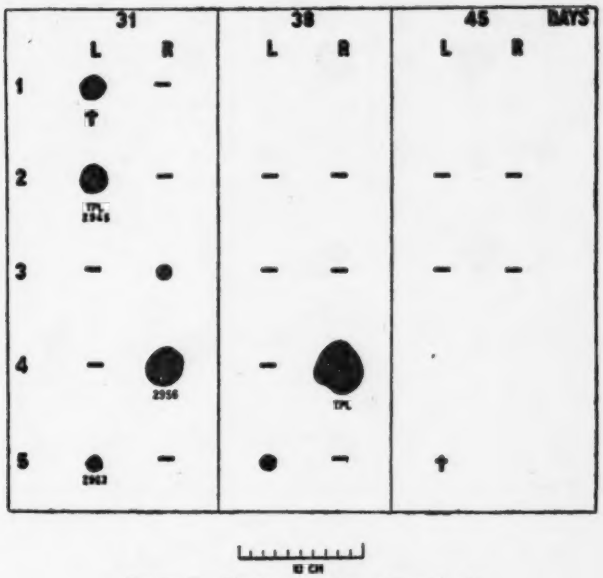


CHART I.—First generation of transplants.

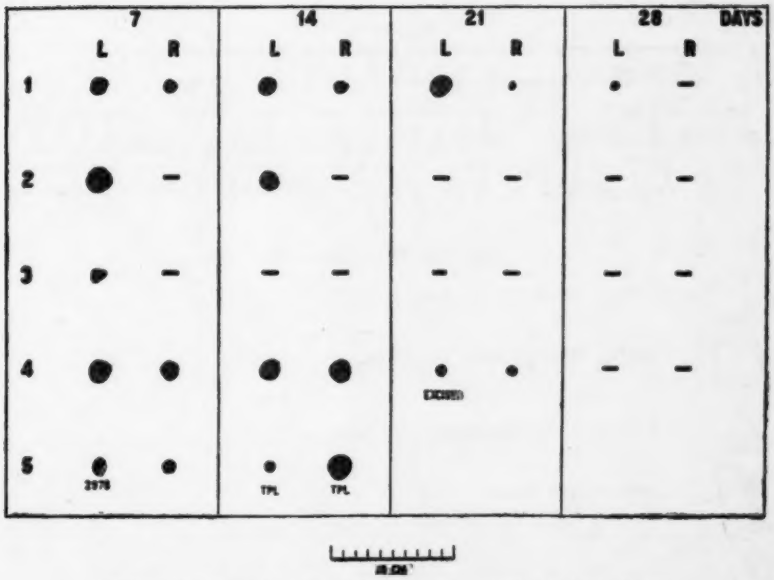


CHART II.—Second series of the second generation of transplants.

Microscopical Examination (Fig 4).—Sections show the tumor to be only partly encapsulated. The capsule is made up of a thin layer of connective tissue containing many newly-formed blood-vessels. The stroma of the tumor is composed chiefly of spindle-shaped connective-tissue cells which are densely

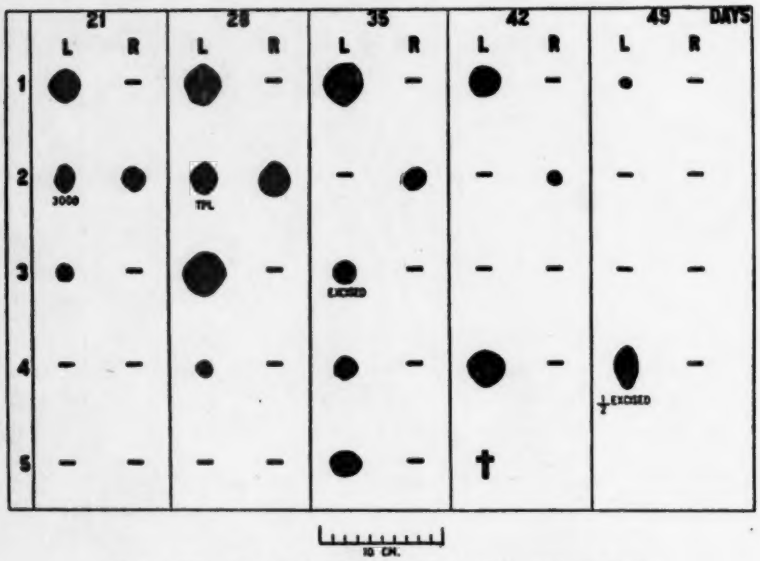
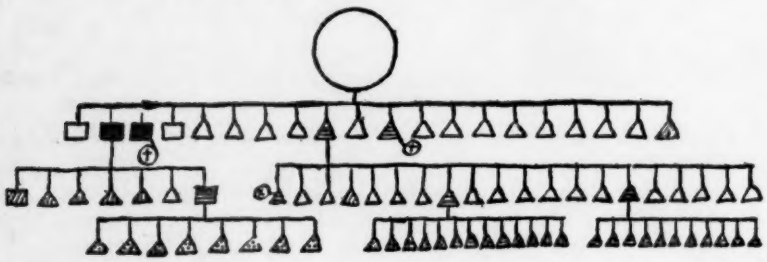


CHART III.—First series of the second generation of transplants.



Pedigree of Transplanted Tumor.

Primary tumor of original host.

Puppies transplanted with tumors.

Adult dogs transplanted with tumors.

A progressive tumor

A regressive tumor.

Dogs in which the tumor strain died out. The exact number of takes in this series was not recorded, as the intial growth soon gave way to regression and complete disappearance.

Animal died.

CHART IV.

packed together near the surface, and are apparently growing very rapidly. Toward the centre the cells are much more loosely woven and are more round than spindle; and by their intense staining show evidence of high activity. The centre is made up of broken-down cells, lymphocytes, red blood-cells, and fibrin. Scattered at irregular intervals throughout the tumor and situated far beneath the surface are areas of spongy bone. The tumor as a whole shows many newly-formed blood-vessels throughout the stroma.

Surgical Pathology No. 2963. Macroscopical appearance. Specimen consists of an oblong tumor mass, measuring 2×1 cm., regular in outline, and well encapsulated. On section the tissue is dense, cuts with difficulty and has a decidedly gritty feel.

Microscopical Examination (Fig. 5).—Sections show the tumor to be well-encapsulated. The thick capsule of the tumor is made up of dense connective tissue. Beneath the capsule are areas of calcification, from which strands of very densely packed connective tissue extend inward toward the centre of the tumor. As they approach the centre, the strands become less dense and finally merge into a loosely scattered mass of connective-tissue cells. This picture shows beautifully the transition between the loosely scattered connective-tissue cell and spongy bone.

Surgical Pathology No. 2945. Macroscopical appearance. Specimen consists of a small partially encapsulated tumor mass measuring 1.5×0.75 cm. On section it is firm, cuts easily and apparently is of the same consistency throughout.

Microscopical Examination (Fig. 6).—Sections show tumor to be only partially surrounded by a capsule consisting of a thin band of connective tissue, the stroma being formed of connective-tissue cells of the spindle type. Toward the centre of the tumor there is a small circumscribed area consisting of degenerated cells. The tumor infiltrates the surrounding tissue through breaks in the capsule, and its growth is very active as may be seen from the number of mitotic figures. This tumor is moderately vascular. There are a few vessels in the stroma, but the greater number are situated near the periphery.

Second Generation of Tumors.—The tumors developing from transplants taken, at the time of excision, from 2956 and 2945, were selected for description because they are typical of this series.

Surgical Pathology No. 2978. Macroscopical appearance. This growth, the result of plants taken from 2956, is an encapsulated mass measuring 1.65×0.6 cm. On section it is found to be firm and of homogeneous consistency throughout.

Microscopical Examination (Fig. 7).—Section shows tumor to be surrounded by a capsule of dense connective tissue. The stroma consists of a densely-packed mass of spindle-shaped connective-tissue cells showing a uniform arrangement throughout the whole extent of the tumor. The large blood-vessels are confined to the capsule; the stroma is apparently without very abundant blood supply. Although the tumor from which this plant was taken developed bone, in this generation all evidence of it is lacking. The conditions which made possible the development of bone in the tumor of the first generation were apparently the same in the second, with one possible exception, namely, the puppies were considerably older than those of the first generation.

This series then resembles in its growth all the transplanted tumors with the exception of the transplants in two puppies in which bone developed.

Surgical Pathology No. 3000 (Fig. 8). Macroscopical appearance. This

tumor, typical of this group, a transplant from 2945, consists of an encapsulated, irregular, oblong mass of tissue measuring 2.3 × 1.2 cm. On section it is found to be of firm consistency, excepting toward the centre, where it is soft and friable.

Microscopical Examination.—Sections show the tumor encapsulated by a thin layer of connective tissue. At one point the capsule has been broken through and the neighboring tissue is infiltrated by the tumor cells. The tumor is made up of irregularly arranged masses of spindle-shaped connective-tissue cells densely packed at the periphery, and much looser as the centre is approached. The centre consists of a homogeneous mass of broken-down cells. This area is completely surrounded by round cells. The tumor is only very moderately vascular; the majority of the vessels are confined to the capsule.

Third Generation.—In this generation the tumor strain died out. The transplants were made indiscriminately in adult dogs because of a lack of puppies and dogs of proper breed. Although the majority of these grafts underwent an initial growth, the limit of their proliferative capacity was reached in producing in some cases nodules 1 cm. in diameter. It was remarkable with what rapidity these tumors disappeared, for one measuring more than 1 cm. in diameter was not palpable at the end of a week. The microscopic picture of a regressing tumor may be briefly described as usually consisting of a rim of living tumor cells completely infiltrated with round cells, and having for its centre a homogeneous mass of broken-down cells.

SUMMARY AND CONCLUSIONS

1. A mammary chondro-osteosarcoma arising spontaneously in a dog has been transplanted into other dogs through three generations, covering a period of ninety days.

2. By far the most successful growths took place in very young puppies and particularly in those of nearly the same breed as that in which the original tumor grew.

3. The tumor showing bone as found in the puppies of the first generation more nearly resembled the original tumor than did the growths in adult dogs.

Therefore it is not unreasonable to assume that by using very young puppies of the right breed, a tumor strain might be developed similar to that already established in rats and mice.

A TRACTION BANDAGE FOR REDUCTION OF FRACTURE OF THE LEG

By Howard D. Collins, M.D.

of New York

visiting surgeon to the city and knickerbocker hospitals

The writer has been much annoyed by the inconvenience experienced while applying plaster-of-Paris bandages or moulded splints to fractures of the leg, where traction has to be maintained by an assistant, owing to the fact that the assistant has to let go with one hand or the other at every turn of the bandage about the ankle or foot and in re-grasping the limb compresses and deranges the bandage.

To overcome this disadvantage the writer has tried various "hitches," or turns, of a bandage to be placed about the foot, allowing the assistant to exert traction on the ends of the bandage at some inches away from the foot, thus keeping up a steady and continuous pull; the operator in the meanwhile applying his plaster or splints over the traction bandage and leaving the latter *in situ* at the close of the procedure.

The objection to the usual " hitches," or turns, is that the traction is always too far forward along the foot and never in a line with the long axis of the leg. Furthermore, these turns exert too much constriction and would be unsafe if left incorporated in the final dressing.

The bandage here described overcomes both these objections and has been tried out to the great satisfaction of the author.

The essentials are a good stout canton flannel bandage three inches wide and two yards long; two pieces of felt one-quarter inch thick and four inches wide, one piece to be six inches long, the other four inches. The longer piece of felt is laid across the front of ankle and instep, the other over the tendo achillis. The object of the felt is to prevent discomfort from any wrinkling of the bandage and possible excoriations.

The bandage is applied according to the turns shown in the accompanying drawings. The felt pads are not shown in the drawings in order to avoid confusion.

In Fig. 1 we see the first turn of the bandage—a simple turn about the ankle with a return at the point *B*. This reduplication can be made nearer the heel or further towards the instep, depending on whether we desire the line of pull to be back or front of the malleolus—in the illustration the reduplication is at the line of the internal malleolus. The end *C* is carried across the front of the ankle as far as point *D* (Fig. 2).

Here the bandage again turns back on itself, making a loop at point *D*, and passes again across the front of the ankle and, going completely around the ankle, slips through the loop *D* (Fig. 3) and hangs down for one of the traction ends. The loop *D* must have the same relative relationship with the external malleolus as loop *B* has with the internal malleolus, so that the traction may come true and square. As has been

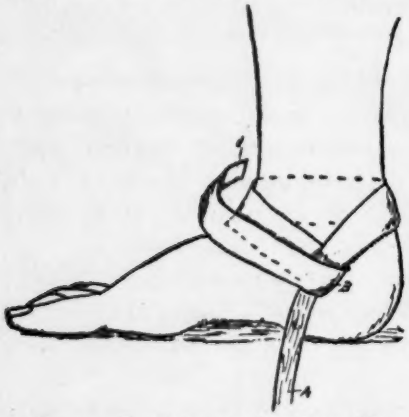


FIG. 1.—First turn, seen from inner side.

FIG. 2.—Second turn, seen from outer side.

FIG. 3.—Completed bandage, seen from outer side.

FIG. 4.—Completed bandage, seen from inner side.

already stated, loops *B* and *D* may be adjusted further forward or back to meet the exigencies of the case.

Fig. 4 shows the complete bandage seen from the inner aspect.

Traction is exerted by the assistant pulling on loose ends *A* and *C* (Figs. 3 and 4), and the force pulls in a line vertically through the loops *B* and *D* wherever they may be placed. The bandage with the felt pads is incorporated in the plaster (bandage or moulded splints) and at the

conclusion of the operation the loose ends *A* and *C* are cut away. With this bandage the pull is exerted in the right direction and the bandage will not slip off the heel.

At first glance a very proper objection may be raised, namely, that we have applied a strong constrictor about the ankle, stopping circulation, and have left the same in place at the conclusion of the operation. There is no question that traction on this bandage will certainly stop venous return, but it is remarkable how instantly and completely the bandage relaxes and loosens itself the moment traction is released. The relaxation takes place even after the incorporation in the final dressing if we exert a little care not to make our plaster too firm over the loops *B* and *D*.

THE SLIDING GRAFT AND THE KANGAROO SUTURE IN FRESH FRACTURES: ALBEE TECHNIC

By Walter Lathrop, M.D.

of Hazleton, Pa.

surgeon to the state hospital of pennsylvania

When we speak of operating for fractures, whether for recent, old, or ununited conditions, the Albee methods at once come to mind, and no one, who has had any fair experience, will hesitate to give full credit to the technic that has in many ways placed bone surgery on the sound foundation upon which it rests to-day. There is no doubt but that fractures cause more trouble to the mind of the conscientious surgeon than any other of the many conditions he is called upon to treat, and it is certain that the proper handling of the average case requires study and care on the part of all concerned.

It is only a few months since I heard a surgeon of very large experience, who stands at the very front, and is an authority on fractures, say: "The more experience I have, the more I am afraid of fractures. I dread to see them come in the hospital." If this be the feeling of one who knows the subject, how important for all those whose work is apt to draw this class of cases, to use every means at their command to get as good a result as modern methods and teaching should give, and which will ere long be demanded by those competent to decide.

Previous to October, 1914, our work in the fracture line, while extensive, was not, from any operative standpoint, satisfactory, nor were the non-operative cases a striking success, though functionally the majority turned out very well. Compound fractures, immediately cleansed, and wired, or plated, did fairly well, but often the wires, nails, or plate, acted as a foreign body, and ultimately required removal, and in some cases a curetting for necrosed bone. I am ready, and free to admit, that *faulty technic* was responsible for some bad results, or failures; for all surgeons of experience know, that in no class of cases does *infection occur so easily* as in bone surgery, and further, there is no work that requires such *absolute asepsis,* and freedom from handling. Compared to *opening a joint,* or repairing a fractured bone, working in the abdominal cavity is easy, *as far as infection is concerned.* While the operative treatment of fractures by plates has received an extensive trial by such men as Sherman, Lowman, Walker, and others, the fact that many of these plates have had to be removed, or have

caused non-union, softening, and necrosis, shows that the danger of plating is not to be forgotten.

The work of Albee has progressed so rapidly that the great value of the autogenous graft is now admitted by everyone who has studied this method, while the large number of successful operations has conclusively proved its worth and adaptability. Sherman, and Lowman, at the last meeting of the Pennsylvania Railroad Surgeons, both gave some excellent statistics for the Lane plate, in properly chosen cases, and in their hands some fine results have been achieved; but Dr. Lowman was emphatic in pointing out the weak points of the plate, and was equally enthusiastic in his views of the inlay bone graft, and kangaroo suture, as a most valuable method of treatment, and the ***most certain of all in ununited fractures.***

For some months past we have been operating on a number of fresh fractures that have been difficult to reduce, and hold in position, *after a fair trial.* Each case is X-rayed on admission, the patient is then etherized, the fracture reduced, immobilized, and again a plate is made to see the position. Often one view shows an apparently fine condition of the parts, but another view will show poor apposition, hence the importance of taking several skiagraphs. If, after five to ten days, the limb appears to be in good position, as shown by measurement and examination, it is not interfered with, as far as operation is concerned. If, however, there is deformity, or over-riding, we do not delay, but after carefully preparing the skin by cleansing with benzine, followed when dry with tr. iodine, we cut down upon the fracture, making a free incision, and either put in a *sliding graft,* taken from the *upper fragment,* as advised by Albee, and fastening with kangaroo tendon; or, as can be done in most cases of fresh fracture, we put the ends in position by means of clamps, and then fasten them by what we term the *"Albee suture,"* that is, two holes are drilled through each fragment in such direction that, when the kangaroo tendons are passed through, they will *cross each other in the medullary canal,* and when tied, will hold the ends of the bone in apposition, without slipping.

In the case of an overlapping, or oblique fracture, the holes are drilled straight through, so that the gut is passed in from one side to the other, then back, and tied on the same side—*a mattress suture.* Two of these are sufficient. The wound is then carefully sutured, and after applying the dressings the limb is put up in plaster-of-Paris. This method applies chiefly to the tibia, humerus, radius and ulna, but we have used it in several fractures of the middle third of femur.

Fractures of the radius and ulna, which are often so troublesome,

are quickly repaired by a single kangaroo tendon passed through a small drill hole in each fragment, and the results are most satisfactory. One of our cases (Figs. 1 and 2) was a young lad of seventeen years, who had fractured his femur *seven weeks previously* to being sent to the hospital; the skiagraph showed wide separation of ends, and considerable callus; the shortening was over two inches. He was prepared for operation, and a long incision made down to the femur. The callus was loosened, and by means of long bone forceps the ends were lifted out of the wound and freshened; double holes were then drilled in each fragment, by the Albee motor, after which heavy kangaroo tendon was passed through the bones, which were carefully forced into apposition, and the sutures tied. The wound was then closed, and the entire limb put up in plaster. The result was splendid, and the young man walked out of the hospital without crutches, and resumed his occupation on a farm, just one hundred and twenty-six days after operation. This case is cited to show the advantage of simple fixation with these heavy kangaroo tendons, followed by plaster cast, instead of plate, or wire. Of course, in an ancient fracture, the inlay graft would be the proper method of treatment. Another case, also shown (Figs. 3, 4, 5 and 6), was one where litigation was expected, owing to the cause of injury: collision between automobile and motorcycle. The young man received a bad fracture of both tibia, fibula and humerus. Repeated efforts failed to get these bones to stay in apposition, and several days after admission operation was performed, and muscle found interposed between the fragments. The Albee suture was used in both tibia and humerus, and after careful closing, plaster-of-Paris was applied. His recovery was uneventful, and his use of the leg is absolutely perfect; the ends of the bones in the humerus moved slightly, but the result is excellent, with full use of arm. I am confident that this case would have turned out badly had the open reduction and suture not been done.

Another case was a young lad who was struck by an automobile, sustaining a fracture of tibia and fibula, with the fragments driven into the muscles. The tissues were greatly swollen, and reduction under ether was only partially successful, as the interposed muscle caused slipping of the ends. After waiting *eight days* for nature to put the parts in the best condition for operation, the fracture was exposed by a long incision, and *sliding inlay graft,* taken from the upper fragment, was put in place, and held by the kangaroo tendons (Albee method). The wound was carefully closed and leg put in plaster cast. The *final result* (Fig. 7) was all that could be desired, and the case

FIG. 1.—Fracture of femur seven weeks before admission. Immediate operation—Albee suture.

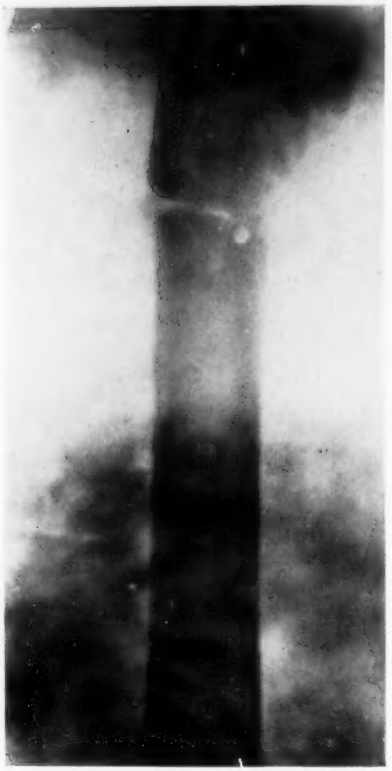


Fig. 2.—Showing parts ten days after operation—note callus where ends were separated during operation; leg in plaster-of-Paris. This boy had a practically perfect result when discharged, April 8, 1915. Resumed regular work on farm in June.

FIG. 3.—Compound comminuted fracture of tibia and fibula. Operation—Albee suture; plaster-of-Paris.

FIG. 4.—Operation—Albee suture; ten days in cast. Result perfect—no limp.

FIG. 5.—Fracture of lower third of humerus; fragments imbedded in muscles. Repeated attempts to reduce, under ether, failed. Albee suture performed.

FIG. 6.—Operation—Albee bone suture; ten days after operation, muscle spasm moved fragments slightly. Result perfect in every way.

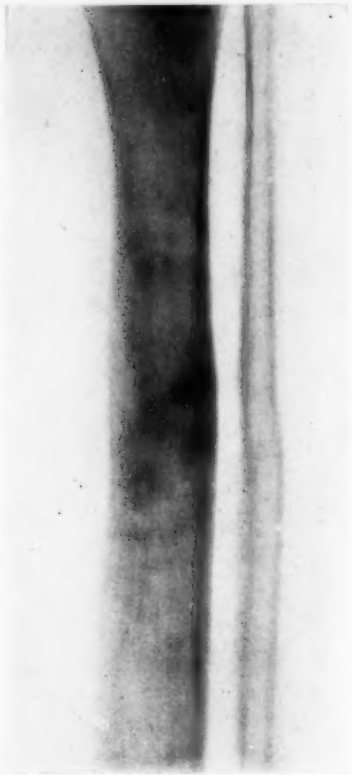


FIG. 7.—Fracture of tibia and fibula; fragments imbedded in muscles. Operation—sliding inlay graft. Radiograph shows final result, September, 1915.

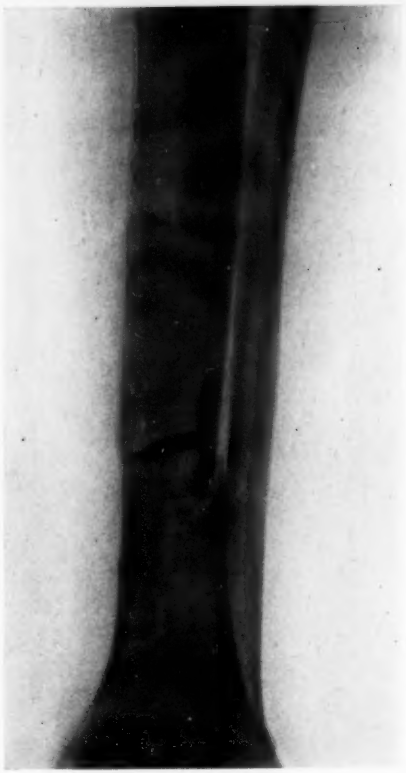


FIG. 8.—Patient had hemorrhage and some necrosis; later small abscess; secondary hemorrhage. Operation—inlay graft and bone pegs (first case of inlay graft). Radiograph shows bones six days after inlay graft. Patient now has fairly good use of leg (1916).

FIG. 9.—Comminuted fracture of tibia and fibula.

FIG. 10.—Operation—Albee suture; plaster-of-Paris. Patient is now (February 1, 1916) perfectly well and has no limp.

FIG. 11.—Compound fracture of tibia and fibula. Operation—sliding inlay graft; plaster-of-Paris. (See also "Bone Graft Surgery," Albee, page 160.)

FIG. 12.—Compound fracture of tibia and fibula treated by Albee sliding inlay graft. Radiograph taken fifteen days after operation.

FIG. 13.—Vicious union of tibia and fibula (left) when admitted, December 31, 1914, with constant pain in foot. Treated by inlay graft. Discharged February 21, 1915, improved.

FIG. 14.—Vicious union of tibia and fibula, fifteen months after accident. Operation—Albee inlay graft; plaster-of-Paris. Nine months after operation patient had excellent result.

FIG. 15.—Old backward dislocation of knee, ankylosis, and deformity (side view, before operation).

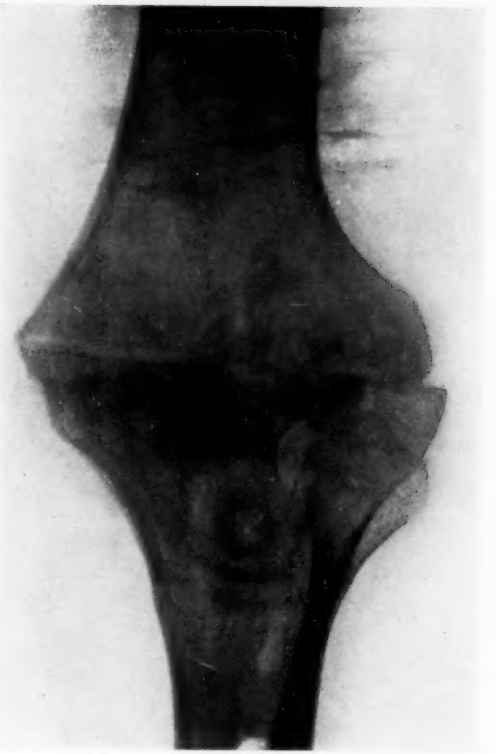


FIG. 16.—Operation—resection; Albee kangaroo sutures; plaster cast. March 20, 1916, primary union of wound; bones united.

was settled out of court for a trifling amount. A remarkable thing about the autogenous graft is its tendency to live and grow in the presence of infection and pus. We have had six cases in which infection occurred, due in some of them to the very bad condition of the parts from crushing, and in which we worked to give the men a fair leg rather than resection, or possibly amputation. In only two cases did we have to remove the inlay graft, which became loose. In one of the cases, after *replacing* (*twelve days from the first insertion*), and fastening with kangaroo tendon, the leg continued to drain, but the *graft grew in place,* and the bones united; so the man to-day has firm union. So much for the vitality of the inlay graft.

Our first case, done in October, 1914, was the most annoying of any. This man had his leg crushed by a mass of coal, and his skin and muscles were so torn that it was a case for serious consideration of amputation. After waiting a few days, we decided to suture the soft parts, and put in an Albee graft. This was done, and apparently successfully, but the tissues were so devitalized by his injury that several days later he had a severe hemorrhage, followed by breaking-down of the flesh. The graft held its place, however, though we used bone pegs, and feared they would loosen. Later, after much attention and dressing, he apparently healed and was sent home. He developed a small abscess, and slight necrosis, over two months later; this healed up. The graft became strong, and yet his leg had slight lateral motion. Now, over fifteen months since injury, he walks with the aid of a cane, but has not gotten the strong leg we had looked for. He was also treated in a Philadelphia hospital by a well-known surgeon, who put him on good-sized doses of *iodide of potash,* and, when last seen, the man had improved. I think that this rather tedious case can be explained by the severity of the injury, repeated hemorrhages, and local abscesses; and, further, it was our first inlay operation. The graft, however, was never disturbed, and grew as firmly as possible, and helped very materially to save the leg (Fig. 8).

As Albee has said, the surgical problem which presents itself is not the securing of better fixation, and a more close approximation of the fragment ends by bone removal and freshening (in non-union), but the furnishing of an *efficient internal splint* and at the same time a *bone-growing* and *osteoconductive element* which spans these sclerosed areas, and is at the same time closely and favorably contacted with the healthy, vascular, osteogenetic bone in each fragment *beyond* the eburnated area, and distal to the point of fracture. The inlay bone graft fulfils all these requirements, and even more, in that it acts as a strong

stimulus to *osteogenesis* on the part of the host fragments themselves. While in these non-union cases the graft is usually taken from the tibia, in fresh cases the inlay can usually be taken from the *upper fragment* and *slid into place.* This can be done often in cases of *non-union,* with excellent results, if not of too long standing.

In our last series of fractures of femur, tibia and fibula, and radius and ulna, and patella, one hundred and forty-three (143) in all, we operated in forty-one (41) cases. These were as follows:

Ununited fracture femur (7 weeks) (illustrated) (Albee suture)	1 case
Fracture of femur (fresh) (Albee suture)	3 cases
Fracture tibia and fibula (fresh) (sliding inlay graft, Albee)	6 cases
Fracture tibia and fibula (fresh) (Albee suture)	11 cases
Fracture tibia and fibula (compound) (sliding inlay graft, Albee)	1 case
Fracture tibia and fibula (compound) (Albee suture)	9 cases
Fracture tibia and fibula, and humerus (illustrated) (Albee suture)	1 case
Fracture of humerus (Albee suture)	2 cases
Fracture radius and ulna (ununited, 5 months) (Albee sutures both bones)	1 case
Fracture of ulna (ununited, 2 months) (Albee suture)	1 case
Fracture of ulna (ununited, 4 months) (Albee inlay graft)	1 case
Fracture of patella (Albee suture)	4 cases

We have had in the wards a series of *two hundred and thirty-two* (*232*) *fractures* of various bones, occurring between October 1, 1914, and December 31, 1915. Among this number there were:

Fracture of femur	24
Fracture of tibia	26
Fracture of fibula	9
Fracture of tibia and fibula	33
Fracture of tibia, compound	4
Fracture of tibia and fibula, compound	13
Fracture of radius and ulna	8
Fracture of radius and ulna, compound	4
Fracture of radius	4
Fracture of ulna	2
Fracture of humerus	11
Fracture of humerus, compound	1
Fracture of patella	4
Total	143
Old dislocation knee, resection	1 case
Arthritis deformans, knee, resection	1 case

This makes *forty-one* (41) cases operated upon out of *one hundred and forty-three* (143), showing, I think, a *fair conservatism,* though

I am free to say that, in view of present conditions, I should have done more " sutures," and *all of the compound fractures of lower leg.*

I hope to report a larger series by the end of another year, and in view of the compensation law, now in effect, there is no doubt but what more will be demanded in the way of shorter periods of disability, and if it is shown that the cases operated upon by the Albee technic do better and are restored quicker than by other means, then the choice will be for that method, but *always under strictest asepsis, and by those qualified to do it,* and who *are in daily touch with operative technic.*

To sum up, we would state that from our experience in several hundred cases, during the past few years, and having used wires, plates, nails, and later the Albee methods, that the *latter offers by far the best means* by which good results may be gotten, without resort to any foreign body. The simple method of *kangaroo suture* is of vast benefit in cases of fresh, overlapping, or obstinate fractures of arm, forearm, or leg, and in the shaft of the femur can be used with success; while, if desired, the *sliding inlay graft* offers a method whereby success will be gotten in the majority of cases where ordinary reduction is not satisfactory.

The X-ray should always be used, an *anæsthetic should always* be given, and *attempts to reduce without operation* should be made; and, these failing, the open treatment by graft, or suture, is indicated.

Compound fractures can nearly always be placed in apposition and held by the *kangaroo tendon.* Plaster-of-Paris is the *best means of immobilization,* and should be applied smoothly, being careful to pad the parts carefully.

FRACTURES OF THE FEMUR *

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General Considerations.—A fracture of any bone of a living human being is not simply "a solution of the continuity of the bone," but an injury which, in the large majority of instances, is a complex traumatic condition, consisting of the break in the bone and injury to the soft tissues of the part involved, of greater or less severity. In some cases the injury to the soft tissues is of more importance than the fracture of the bone itself; in the majority of cases the injury to the soft tissues is of great importance; and in no instance, except perhaps in the rare cases of so-called "green-stick fracture," may they be neglected or forgotten in treating the case.

The cause of fractures is usually stated as (*a*) direct and (*b*) indirect violence. In civil life fracture by direct violence is comparatively rare. Of 739 cases analyzed 120 were from direct violence and 619 resulted from indirect violence.

I have analyzed the conditions and histories of a large number of indirect violence fractures, and I feel sure, in nearly every instance, the fracture of the bone, if it were a long bone, was produced by incoördinate leverage.

When a human being uses his extremities voluntarily for motion and locomotion he accomplishes these acts by coördinate leverage, the motion to the levers (the bones) being applied by the coördinate use of the proper muscles. If taken unawares, the position of the extremity or the position of the trunk may be such that even slight momentum results in violent incoördinate leverage, and a fracture may result.

As regards the number of fractures in the several age periods, the British and American statistics differ somewhat. They are as follows:

American, No. cases[1] studied, 344.		British, No. cases[2] studied, 716.	
Under 10 years	90	Under 10 years	394
10 to 20 years	65	10 to 20 years	155
20 to 50 years	122	20 to 50 years	77
50 to 70 years	55	50 to 70 years	90
70 to 90 years	12	70 to 90 years	0
Total	344	Total	716

* Read before the Philadelphia Academy of Surgery, March 6, 1916.

Of 751 American cases [3] reported the kind of fracture was:

Simple	708
Compound	23
Compound comminuted or complicated	20

The combined reports of the American and British cases make the following classification of locations of fractures of the shaft of the femur:

Upper third	177 cases
Middle third	629 cases
Lower third	186 cases
Total	992 cases

The American statistics do not show, but the British classification indicates the prevalence of fractures of the femur in the several regions as regards the age periods, as follows:

1. Fracture of the neck of the femur.

0 to 10 year period	4 cases
10 to 20 year period	11 cases
20 to 50 year period	20 cases
50 to 70 year period	67 cases
Total	102 cases

2. Fractures of the upper third of the shaft.

0 to 10 year period	66 cases
10 to 20 year period	19 cases
20 to 50 year period	16 cases
50 to 70 year period	33 cases
Total	134 cases

3. Fracture of the middle third of the shaft.

0 to 10 year period	293 cases
10 to 20 year period	106 cases
20 to 50 year period	43 cases
50 to 70 year period	40 cases
Total	482 cases

4. Fracture of the lower third of the shaft.

0 to 10 year period	35 cases
10 to 20 year period	30 cases
20 to 50 year period	18 cases
50 to 70 year period	27 cases
Total	110 cases

This shows that a remarkable preponderance of fractures of the shaft of the femur in Great Britain occur in childhood.

My own American statistics, not worked out as regards the special regions, show:

5. Fractures of whole shaft considered together.[3]

0 to 10 year period	90 cases
10 to 20 year period	65 cases
20 to 50 year period	122 cases
50 to 70 year period	55 cases
70 to 90 year period	12 cases
Total	344 cases

This indicates that the age period of active hard labor has more fractures of the shaft of the femur in America.

Diagnosis.—Distortion, " false mobility," great pain and local tenderness, ecchymosis, swelling and crepitus, if all are present in any case, one may easily conclude a fracture has occured. Sometimes distortion is difficult to appreciate, no crepitus is felt, and there is fixity of the extremity, only great pain and local tenderness are present, perhaps considerable swelling and some ecchymosis. Such cases may be extremely difficult to determine, especially if the lesion be near a joint.

Careful ocular examination and comparison with the uninjured limb, if the uninjured one is a normal member, careful measurements and the gentlest possible manipulation, continued for only a very short time, may be employed. If this does not suffice to establish the diagnosis, fixation in the position assumed by the extremity should be secured and a radiographic investigation by a competent operator should be made as soon as practicable.

Prolonged manipulation and careless handling or forceful attempts to elicit crepitus should always be avoided. The dreadful pain from these methods of diagnosing causes spasm of the muscles, and on account of the incongruous positions which follow may make the determination doubly difficult.

In obscure cases difficult to diagnose, if manipulation is necessary to establish the diagnosis, it should be postponed until the physician is prepared and ready to make his permanent dressing; then a general anæsthetic should be given, if the patient's general condition will admit of it, and setting should immediately follow the manipulation; or, better still, the manipulations should accomplish the setting, and the permanent splint or dressing be applied at once. Much better, however, is it to reach the correct diagnosis by a skiagram or by fluoroscopic examination.

I very much doubt that a physician who cannot give his patient the benefit of a well-taken skiagram, or himself be able to make a fluoroscopic examination, should, in these modern days, attempt to treat major fracture cases.

The first thing to do is to find out the condition of the individual as regards his strength, condition of shock, manifestations and result of his pain, etc. The general requirements should first be done, then the special ones be attended to.

Shock in many cases is marked and requires care and discrimination in managing it. The early shock, that which comes on immediately after the injury, is a psychical one, or due to "anoci associations." This is best treated by morphia given in full doses. Persistent or late shock means hemorrhage, as a rule. This may require exploration by incision, and packing of the lacerated cavity, or ligation of bleeding vessels.

Pain and muscular spasm are the special ever-present and overpowering immediate sequel of fractures of the femur. The pain is so severe and trying in many cases it rapidly exhausts the patient. The position of the fragments sometimes aggravates the pain. One should try rapidly and gently to ascertain in a general way whether the fragments are pressing against the skin or the nerves, and place the limb in such a position that this pressure shall be relieved. Then give a full dose of morphia, and immobilize and fix the extremity, unless one is prepared at once to reduce and splint the fracture. In this latter case a general anæsthetic should be given and all manipulations be done in anæsthesia.

In complete fractures of the shaft of the femur there is always more or less hemorrhage. I have seen tremendous extravasation of blood subcutaneously and between the muscles in some cases. One should estimate the severity of the hemorrhage by the tension and general quality of the pulse, and by the size of the hæmatoma about the fracture, and should direct his measures accordingly.

Active stimulation, hypodermo- or proctoclysis, and in a few instances intravenous saline solutions, must be used. Unless the physician has the benefit of a well-equipped operation room and thoroughly aseptic technic he should open the soft tissues only from dire necessity; these instances will be very rare. A tourniquet or elastic bandage should be used only when nothing else avails.

The first aid or preliminary treatment should be only gentle extension and fixation of the limb in extension, until the patient may be taken for his permanent dressing.

Prolonged attempts at reduction, or manipulations for the establishment of the accurate relative positions of the fragments when the examiner is not prepared immediately to put on his permanent or final dressing are reprehensible, because they are unnecessary and brutal.

When the patient must be transported the limb should be fixed in the position in which it is found, unless the fragments are evidently pressing on the skin or on some nerve trunk. In the latter case sufficient variation of the position must be made to relieve this pressure, then the limb should be fixed.

Except in cases of fracture of the neck within the capsular ligament, a general anæsthetic should be employed in manipulating and reducing the fracture. This is best, even in cases where Buck's extension or some variation of the Buck's extension is to be used.

It must always be borne in mind that no two cases of fracture are exactly alike. For this reason the same apparatus cannot without modification be used with different individuals, even though the fracture of the bone seems exactly alike. The apparatus must be adapted to each individual case and not the case to the apparatus.

Fractures of the femur may bring about the death of the injured person. The 760 cases studied showed a death-rate of 3.69 per cent. Shock,[8] pneumonia and delirium tremens following the fracture caused most of the deaths.

General Management of Fractures of the Femur.—It should always be borne in mind that text-book statements are at best average statements; they, as a rule, try to note what the ordinary displacements, signs and indications of a particular fracture should be. Usually these statements are based on anatomic and mechanical considerations entirely. The physiologic and pathologic forces are not usually recognized or regarded. For instance, fractures of the upper third of the shaft of the femur are stated to be followed by upward and outward displacements of the proximal fragment and upward and inward displacement of the distal fragment, according to the books, and anatomically it should be so. As a matter of fact, in one case at least, I have seen almost the reverse condition.

Displacements and distortion in every case will depend upon the extent and severity of the injury to the contiguous soft tissues. A muscle which ordinarily should produce a certain special deviation of the fragments may be almost or completely paralyzed by the severity of the injury, and another muscle which ordinarily cannot successfully oppose it may be stimulated to tetanic spasm, and by its superviolence produce an entirely different or widely varying distortion and displace-

ment from that the books and ordinary experience have taught us to expect.

Again, most of the innervating nerves may be severed, or the main nerve trunk be almost crushed by the leverage and weight of a fractured femur. Paresis of the muscles may follow; gravity and leverage alone will then determine the displacement. Congenital or acquired previous distortions also influence displacements. Therefore, a safe postulate for handling and treating any case of fracture of the femur is, never take anything for granted, determine each individual case accurately and carefully and treat it according to its individual requirements.

Some years ago I was called in consultation and asked to reduce a fracture of the lower third of the femur in the case of an old man. The physician in charge told me he had tried repeatedly, always unsuccessfully, to reduce the fracture. It was a fracture almost transverse and the old gentleman was rather thin. I thought by etherizing him I should certainly be able to reduce and retain the fracture in place. I was astonished and greatly chagrined to find that my assistant and I by any of the ordinary means and methods could not reduce the fracture. Finally, it occurred to me to examine the uninjured lower extremity. I found the most exaggerated case of bow-legs I had ever seen. This gave me the necessary indication. By changing the direction of the traction and using a fulcrum just above the knee-joint, the adjustment was quickly and easily done.

TREATMENT OF THE FRACTURES OF THE SEVERAL REGIONS OF THE FEMUR

Fracture of the Neck.—This fracture usually occurs in old people or in middle-aged women, unless it is produced by direct violence.

In the senile cases it is commonly intracapsular. When it occurs in healthy adults, the fracture is apt to be near the junction of the neck with the shaft and it is partially extracapsular, especially posteriorly. The last form may be impacted, the former never.

The age of the patient, the history of the case, viz., a sudden trip and fall followed by inability to stand, great pain in and about the hip sometimes running down to and also felt in the knee; extremity easily moved at the hip by manipulation, eversion of the foot, shortening of the extremity, elevation of the trochanter major shown by Nélaton's line or Bryant's triangle, local tenderness, great pain when the extremity is moved, especially when rotation is attempted, will serve to make the diagnosis, provided one may exclude fracture of the pelvis about and including the acetabulum. It is not necessary to attempt to obtain crepitus; to do this is very painful.

The fracture at the junction with the shaft usually shows crepitus by even gentle passive movement. This, in addition to the signs indicated above, will make a diagnosis of fracture easy, but it is not always easy to differentiate between the two, even though one has constantly in mind the fact that crepitus is much more easily elicited in the latter than in the former case. A good skiagram may be necessary to clear up the diagnosis.

Treatment.—Senile cases demand attention to their general condition at once. They are usually in shock on account of the great pain produced, and will require full doses of morphia the first twenty-four hours. While it is true that some old people do not stand confinement in bed well, it is not true of all cases by any means. One must early judge this feature and be guided in his treatment by this determination. As a rule, a dressing and apparatus should be employed which will enable the patient to move about a little in bed and to change position from time to time. It is rigid fixation in one position in bed and pain which prove so exhausting to old people. Strong traction and the necessity of remaining fixed on the back are very irksome, and are apt to be painful; hence the ordinary traction devices should not be used for any length of time in cases of old people.

I have found the old Hodgen splint, or the Nathan Smith wire frame splint, most useful in cases of fracture of the neck of the femur.

When the fracture is at the junction of the head and neck, I use more than the 45 degrees of abduction, suggested by Royal Whitman. The injured limb should be swung free of the bed and supported in the Hodgen apparatus, and this, in turn, held by an overhead bar. Traction may be obtained by so arranging the cords which attach the splint to the overhead bar that they are continually drawing downwards, that is, towards the foot of the bed. This is necessary in most cases to overcome the spasm of the muscles and to relieve the grind on the head of the bone.

I have recently treated three unpromising cases in this way with great comfort to the patient, and with a very successful and happy result of the treatment.

For the fractures of the neck at the junction with the shaft, the overhead bar should be only a little obliquely placed as regards the bed, so as to obtain very little abduction. Swinging entirely free of the surface of the bed, suspended, and continually in traction, the limb is comfortable, and the apparatus permits great freedom of movement of the body of the patient and many changes of position. The patient may sit up in bed, and use the bed-pan without difficulty. In a sunshiny,

well-ventilated room, near a window, an old person can stand this apparatus in most instances eight weeks without serious detriment.

Cases which will not endure this method of treatment should have adapted an extension apparatus like the Hutchinson hip-joint brace, or the Thomas brace, and be taken out of bed, placed in a comfortable wheel-chair and wheeled into the fresh air. Massage and alcohol rubs are very grateful and useful adjuncts to the treatment.

Some preparation of nux vomica internally, careful feeding, and diversion, are also very useful in these cases.

Fractures of the Upper Third of the Femur.—These fractures occur most frequently in childhood (NOTE.—See the last paragraphs under "General Considerations," page 76), and are the most difficult of all fractures of the femur successfully to treat, without an open operation.

The signs and symptoms are usually quite classical in these fractures; no difficulty is found in diagnosing the fracture, but it is difficult, especially in a stout, fat or full-muscled person, to determine whether the fracture is oblique or spiral. It is nearly always one or the other.

The tilting upwards, and outward rotation of the proximal fragment, may be overcome by general anæsthesia, which relaxes the spasm of the muscles, and one may accomplish a fair restitution of the fragments, but it is very difficult to hold them in proper place afterwards. In children this may be done by a well-applied plaster cast put on in anæsthesia and reinforced by flexible wood strips laid in on the anterior and outer surface, and carefully fitted and snugly applied from the knee to the umbilical region. Occasionally one may succeed with a similar dressing in cases of thin, weak adults, but for strong, robust individuals, in order to preserve the position of the fragments, it will be necessary to employ a system of downward and outward cross-traction, with powerful extension of the extremity by weights, like the Bardenheuer method. I think, however, a better method is to use the Nathan Smith anterior wire frame, curved at the knee so as to obtain flexion at the knee. It should carefully be bandaged in place and then the extremity suspended in a sufficiently rotated position to meet the displaced proximal fragment.

In a recent case, in which there had been extensive superficial lacerations and serious infection, we tried all manner of dressings and positions, without being able to retain good apposition. On account of the infection, no open operation could be employed. The child (nine years old), nevertheless, obtained good union (though the fragments overlapped), and had a perfectly useful limb afterwards. I shall return to this point later on.

As was said before, this is the region of the femur in which, when a fracture occurs, an open operation for replacing and directly plating the fragments themselves is indicated.

Fracture of the Middle Third of the Femur.—These are the most frequent of femoral fractures. They are easily diagnosed as a rule. I have no record of, nor can I remember ever to have seen, but one incomplete or green-stick fracture of the femur; this was in this region. Usually fractures in this region are oblique or spiral; they are sometimes transverse, however. The distal fragment is usually drawn upwards above the end of the proximal fragment, but it may lie in any position as regards the horizontal directions. I have seen anterior, posterior, internal and external positions of the distal fragment as regards the proximal fragment. It all depends upon the nature and extent of the injury.

Middle third fractures are usually considered the ones especially requiring some form of traction method for their treatment. Except in a few selected cases, I have quite lost my preference for traction methods of treating these fractures, since skiagrams so persistently showed me overlapped fragments, inaccurate apposition and nearly always a little angulation, as a part of the result. Besides, a stiff, painful knee-joint is apt to persist for many weeks.

For transverse fractures, I have had better results with a plaster-of-Paris fixed dressing, after reduction in general anæsthesia. This should be removed in three weeks, the limb carefully washed with alcohol, massaged, the joints very carefully moved, and another plaster dressing applied.

Also for oblique or spiral fractures, in most instances, the plaster splint applied in complete general anæsthesia is best and most comfortable. These splints should be applied while the limb is powerfully extended by means of a Lemon or a Lambotte apparatus. Manual extension cannot be kept up unvaryingly for a sufficient length of time. If one has the benefit of a first-class modern fluoroscope to see just what he is doing, he will be very fortunate indeed.

For the traction method I have been accustomed to use for many years a modification of the Volkmann leg- and foot-piece to prevent rotation of the foot, and to lessen friction. My apparatus consists of a leg- and foot-piece, which is bandaged to the leg and foot after the adhesive plaster strips have been laid on. Cross-pieces go out on either side from under the leg-piece and ride on two pieces of hard wood planed to a narrow edge. These are made like an ordinary railroad into flat sections, of varying sizes and lengths. This apparatus raises the

leg and foot a little, keeps them off the bed and slides easily in the running grooves on the track of hard wood. When properly applied the apparatus keeps the foot constantly in proper position and prevents any deviation of the leg.

In some instances Steinmann's nails may be used for extension. I must confess to a prejudice against this method. I prefer plating the fragments when any operation is necessary.

While the little operation of thrusting an aseptic nail through the extremity, including the bone, may itself be attended by little danger, it is quite a different matter during the weeks of traction on this nail, for the soft tissues must be irritated by the pull and movements, produced by the varying position of the patient, and infection is very apt to follow the irritation.

After any method of reduction and dressing, especially after a fixed dressing, such as plaster-of-Paris, has been put on, a skiagram should be taken or a fluoroscopic examination be made to find out clearly whether the fragments are held in good apposition. Overlapping to a slight extent in cases of oblique and spiral fractures will not very much hinder good union and satisfactory function afterwards, provided there is no angulation or rotation of the fragments on the proper axis of the bone.

Overlapping in cases of transverse, or short, iregularly oblique fractures, will make a great difference, however; much deformity, doubtful union, and usually long delayed and never complete function will result. When I find serious overlapping after attempting to reduce and fix a fracture, I make another attempt, and if again unsuccessful in restoring the fragments to proper position, my rule is to operate.

Whatever apparatus is used, in about three weeks at least the limb should be carefully inspected, carefully washed off with alcohol and massaged. The ankle-joint should be thoroughly moved and the knee-joint should also be flexed as much as practicable without provoking spasm of the muscles and displacement of the fragments.

In many instances a surgeon waits too long before he begins massage and passive movements. I would not go so far as Championniere in regard to massage in fractures, but it seems to me it should be employed as early as practicable.

Fractures of the Lower Third of the Femur.—The diagnosis of these fractures is usually easy. The displacement of the ends of the fragments follows the general rule of fractures of the femur below the upper third. The distal fragment is usually drawn upwards as regards the proximal fragment (except in cases of the specific fracture to be

mentioned presently); unless they are badly lacerated, the abductors are very apt to draw the proximal fragment inward; in which case the distal fragment will be found displaced upwards, a little backwards and to the outside.

There is a fracture, however, usually transverse, the displacement of which is, distal fragment backwards and tilted so that the end presses backwards into the upper part of the popliteal space. This fracture is produced by the whirling motion caused by a rotating wheel. Children who jump on wagons and whose lower extremity is caught in the wheel, and workmen caught in slowly revolving large machine wheels, have this special kind of fracture.

The condition is a very characteristic one. It is an extremely painful one, because the end of the lower fragments presses firmly against the blood-vessels and nerves which pass through the popliteal space. Also grave injury to the vessels may result from this pressure. It is, therefore, necessary to reduce this fracture very soon to prevent thrombosis in, or laceration of, the vessels. If it is not practicable to reduce the fracture at once, the leg should be flexed at the knee and immobilized in this position until an anæsthetic may be given and reduction accomplished.

One must have in mind that this fracture is the analogue of fracture of the lower third of the humerus, just above the condyles. Jones, of Liverpool, has taught us that to reduce and to hold the fragments of the humerus in place it is necessary to acutely flex the forearm on the arm and fix it in this position. A similar method of reduction should be used in the supracondyloid femoral fracture, namely, extreme flexion of the knee-joint and manipulation of the distal fragment into place. Ordinarily this may be accomplished, and when reduced, as it is a transverse fracture, one has only to jam the fragments end to end and have them held in this position while the leg is slowly and carefully brought to its proper position. A fixed dressing of plaster-of-Paris may then be applied.

When the violence has been great, however, the displaced lower fragment may be caught between the heads of the gastrocnemius and the hamstring tendons, and lacerated shreds from the fibrous structures may be so wrapped about the ragged ends of the fragments that they will firmly be held, and no manipulation or position will suffice to release them. In this case an open operation will be necessary in order to obtain good restitution of the fragments. Jones, of Liverpool, however, says a Thomas extension splint will accomplish the restitution.[4, 5, 6]

Ordinary fracture of the lower third may be treated by traction

methods, with Hamilton's coaptation splints to prevent deviation. For children and for some not very strong and thin adults, a fixed dressing of moulded splints, preferably plaster-of-Paris, applied in general anæsthesia, may be used to advantage. When the plaster has hardened, the extremity may be swung clear of the bed by attaching bandage supports and cords carried to a bar above the bed. When the reduction has been good, the method of treatment is a very grateful one. Skiagrams should be taken soon after the dressing is applied in order to be sure of the reduction.

Results of Fracture of the Femur.—Up to this time there has not been established any authoritative standard by which surgeons might compare their results after fracture of the femur.

In 1890 the American Surgical Association appointed a commission to determine and report what should be the conditions which should be considered as indicating good end-results after fractures of the femur.

The summary of the report of this commission is as follows:

1. There must be firm bony union.
2. There must be correct axial relations of the fragments.
3. Correct relations of the anterior planes of the upper and lower fragments must be maintained.
4. Shortening must not exceed from one-eighth to one inch.
5. Lameness must not occur as a result of shortening over one inch.
6. The conditions attending the treatment, however, may prevent these satisfactory results.

This is a standardization from an authoritative source, certainly, but it was made before the era of X-ray, and the surgeons of that time did not practise open method for the treatment of fractures.

A committee of the British Medical Association made a report on the results of fractures in Great Britain in 1912, but did not attempt standardization, either of results or disability.

The American Surgical Association has a committee working on this matter of standardization. It is to be hoped that this committee will be able in another year to formulate a standardization which will bring the condition up to date.

Last year this committee made a preliminary report and in regard to fractures of the shaft of the femur its conclusions were as follows: "Fracture of the shaft of the femur should not result in shortening greater than 2 cm., nor in a fixed position of angulation or rotation which will affect the joints and require new habits of balancing or tilting of the pelvis; joint function should be good. No permanent disability of the affected member should result."

Taking the above standardization as existing at present, what is the average result obtained by surgeons who treat fractures of the femur?

In 1912 I made a study of 760 cases of fractures of the femur, collected from many surgeons. Unfortunately, the records of these cases were so incomplete, in most instances, that it was impossible to deduce accurate data from them. Seven hundred of these cases were reported to have made satisfactory recoveries. I presume this may mean that 700 out of 760 cases had bony union.[3]

The Committee of the British Medical Association analyzed 726 fractures of the shaft of the femur and noted 60 per cent. good results.[2] The Committee of the American Surgical Association last year studied 364 non-operative cases, and reported 67 per cent. good anatomical and functional results.[1]

In regard to correct axial relation of the fragments, 620 of my cases had this point noted, 114 of these cases (or 18.1 per cent.) had serious axial displacements.[2]

The average shortening of the reported cases did not exceed 2 cm.

This matter of shortening, however, is a very uncertain one. It is well established that a man's femora are rarely the same length. Sometimes they vary, in what seems normal conditions, as much as 2 cm.[5] I had, not very long ago, a thirteen-year-old girl under treatment, one of whose femora was nearly 3 cm. longer than the other. This was a case of unequal development apparently, however, with the same conditions of the legs on both sides, and like conditions of development, etc.

Then, too, measurements are frequently very carelessly and inaccurately taken and may not be trusted. Therefore, unless lameness results as a consequence of the shortening, or serious tilting of the pelvis and spinal curvature develop as a consequence, I think not more than 3 cm. shortening may result in a good functional result. If there is this much shortening, however, as a result of the fracture, it is surely due to overlapping of the fragments. This will require a large callus to assure firm union, and this, in turn, will produce some deformity and usually cause a good deal of pain for some time.

One must bear in mind now that the almost universal use of X-ray, and the demand of a patient to have a print of the plate, require of the surgeon not only good functional result but good mechanical and good cosmetic results also.

In the report of the 760 cases of fracture of the femur, which I studied, only 130 were reported as skiagraphed; 83 of these, or 63 per cent., showed good apposition.[3] These X-ray cases came from the

best and most systematic surgeons, and cannot be considered the average result obtained by all surgeons by any means. Also, if I may judge by my own experience, this does not express the result of the old conservative treatment, but it is the average result of both methods, viz., conservative and open methods.

Of 299 of my own cases of fracture of the shaft of the femur, 100 of which were compound, comminuted or complicated fractures, the average shortening when they left the hospital was 1½ cm.

All but one of these cases had firm bony union. Only about 2 per cent. of those treated by the conservative method showed accurate reposition of the fragments, when skiagraphed after the permanent dressings were applied.

In one case of compound comminuted fracture, when the fragments were cleared away, I found there was a loss of five centimetres of the shaft, yet this patient made a good functional recovery, and by the use of a high shoe was able to work again.

Axial displacement is a very serious matter in a final result. This not only is apt to lead to distortion of the pelvis and spinal column, but results in persistent pain in the ankle- and knee-joints, and it usually incapacitates a man for further laborious work.

The cases I have been able to trace and follow up have only been about 30 per cent. of my fractures; these have been able to return to their former jobs. These cases had no serious axial displacements. When, some time ago, I found, by the old method of extension, external splints, etc., as I said, only about 2 per cent. of my cases showed accurate apposition, and in many instances cases which seemed in perfect alignment, and showed very little shortening by the usual methods of measuring, when skiagraphed, exhibited overlapping and poor apposition, I became so disgusted that I began seriously to consider, and to practise far more generally, the operative method and direct splinting of the bone.

Of the last 65 fractures of the femur we have treated at St. Luke's Hospital, I find 25 of them were plated, 38.46 per cent., whereas five years ago only 7 per cent. were plated. So far we have had no fatality from these operations, and but one case has been seriously infected out of 25 cases operated. This case passed through the operation and operative convalescence without any infection, but was infected when the pegs were removed. It was a streptococcal infection. He made a good recovery and the union was not disturbed.

What are the advantages of the open method, and when or in which cases ought it to be used?

It will be better to take the last question first. In my clinic at St. Luke's Hospital it is the rule in simple fractures of the femur to attempt reduction in general anæsthesia and while the patient is relaxed and unconscious to apply a permanent dressing. Then the fracture is skiagraphed. If the reposition is not good, especially if the fragments are not in alignment, another effort at reduction is made and again a skiagram is taken. If again the position is bad, the state of affairs is explained to the patient and he is offered the operation. We find patients very rarely refuse to have the operation. Within ten days after the fracture the operation is performed.

To treat the question dogmatically, I would say, fractures of the neck within the capsule should always be treated conservatively.* The open method may be used on such cases only when the head has been dislocated from the acetabulum.

Fractures of the upper third offer especial and cogent indications for the open method.

Fractures of the middle third may best be treated by the open method if they are transverse, and cannot be reduced by general anæsthesia, traction and manipulation. Oblique fractures which have short, irregular bevels or shoulders, and those which have markedly been displaced and have gathered on the ends and between the fragments a quantity of fascia, muscles, etc., are indications for the open method.

A fracture of the lower third, if it be one which has the lower fragment tilted backward in such a way that it has been entangled in the lacerated fibres and fascia of the heads of the gastrocnemius muscle and hamstring tendons and cannot be replaced under ether by manipulation and flexion, should, as a rule, be treated by the open method.

In general, a fracture of any part of the femur, except its neck, which cannot be reduced in anæsthesia, and retained in position by some proper apparatus by the middle of the second week, should have the benefit of an open operation, unless there is a contra-indication in the condition of the patient or there exists some strong social or medico-legal consideration against it.

In determining the question of open or closed method, the surgeon should never forget that a finite operator doing an open operation on a human being can never be sure he is not introducing some sort of sepsis. There is, therefore, always a possible added danger in open operations.

Furthermore, open operations for fractures of the femur require large wounds and are not easy operations to perform. They may prove

* I am aware of J. B. Murphy's opinion to the contrary.

a serious tax on the strength of a patient and must never be lightly undertaken.

The surgeon should not forget all this and he should make the patient appreciate the main factors of the probable result without the operation, and its added danger if undertaken.

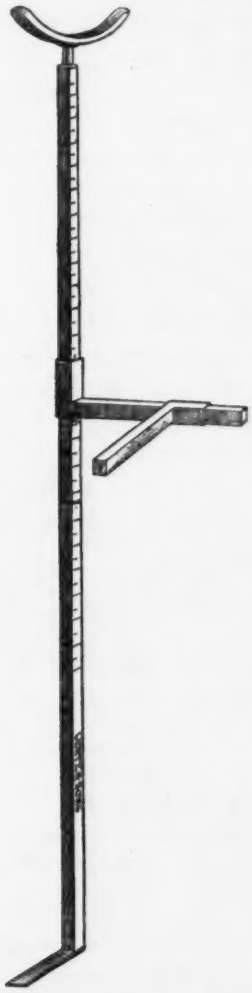

FIG. 1.—Measuring rod used for accurate determination of shortening or angulation after fractures or in deformities of the limbs.

The advantages of the operation are (1) direct ocular examination of the condition of the fragments; (2) reposition and fixation by direct splinting of the bone while under one's eyes; (3) evacuation of the blood and detritus from about the fragments; (4) a condition

almost painless during after-treatment and convalescence; (5) much more freedom of movement in bed while convalescing; (6) earlier employment of passive movements and massage.

As regards results, our experience has been that the operated cases require a little longer period of hospital disability, probably three weeks longer. The alignment is always good and very rarely does any bowing occur afterwards, unless the patient is allowed to bear weight too early. In every instance, so far as we have been able to follow our cases, the patient has been able to return to his former job, except in one case, who fractured his bone while still in the hospital. He has considerable overlapping and callus and shortening as the result of his last fracture, which was treated without operation.

The average period of disability for fracture of the femur worked out in our cases is thirteen months. This means the time a laborer may count as necessary before he may with confidence return to his hard work. Most cases leave the hospital in ten weeks, walking with the aid of a cane or crutches, but it requires a much longer period for them to be able to do a full day's work. Our follow-up system shows, as said above, the average time for full ability is thirteen months.

NOTE.—The author demonstrated a new measuring rod which in his opinion enables one to overcome many of the difficulties and inaccuracies of measuring fractures (see Fig. 1).

BIBLIOGRAPHY

[1] Report of the Fracture Committee: American Surgical Association. Trans. A. S. A. 1915.

[2] Report of the Fracture Committee: British Medical Association. British Medical Journal, November 30, 1912.

[3] End-Results of Fracture of the Femur. W. L. Estes, ANNALS OF SURGERY, July, 1912. Also Trans. American Surgical Association, 1912.

[4] Robert Jones, Ch. M.F.R.C.S.I.: Present Position of Treatment of Fractures. British Medical Journal, December 7, 1912.

[5] John B. Roberts, M.D.: Variation in the Lengths of the Femora of the Same Skeleton. Philadelphia Medical Times, August 3, 1875.

[6] Jarvis S. Wright, M.D.: Inequalities of the Lower Limbs. Archives of Clinical Surgery, February, 1877.

[7] Algernon T. Bristow: Observations on the Inequalities of the Right and Left Femur. Trans. American Surgical Association, 1908, vol. xxvii.

FIG. 1.—Jig-saw osteotomy for deformity of knee following a resection for tuberculosis (thirteen years). Lateral view (November 13, 1914).

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

Stated Meeting, held November 10, 1915

The President, Dr. Chas. N. Dowd, in the Chair

JIG-SAW OSTEOTOMY FOR DEFORMITY OF KNEE

Dr. H. H. M. Lyle presented a youth, aged twenty-one years, who had had a resection of the knee for tuberculosis performed thirteen years ago. Shortly after this operation a marked flexion deformity appeared. The knee was firmly ankylosed at 135°, there was 4½ inches shortening, and the patient was unable to walk without the aid of crutches. X-ray plates and photographs were shown to demonstrate the condition before and after the operation.

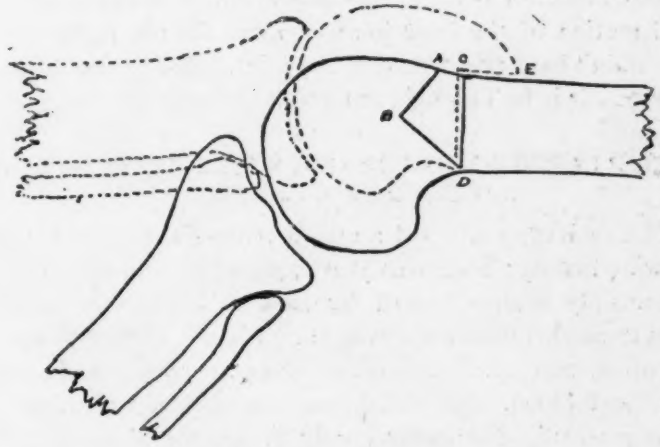

Fig. 2.—Osgood's osteotomy.

Considering the past history, and knowing the difficulties of maintaining a correct alignment after the ordinary osteotomy, Dr. Lyle decided to perform Osgood's operation (The End-Results of Attempts to Mobilize Stiffened Joints, Surg. and Obst., 1913, xvii, p. 664). Operation, St. Luke's Hospital, December 11, 1914 (Figs. 1 and 2). Under gas and oxygen two lateral incisions just above the condyles were made. These two incisions were then joined by tunnelling between

the anterior surface of the femur and the posterior surface of upper cul-de-sac of the joints. A blade of a carpenter's copying saw was inserted, adjusted to the handle, and the cut *C.D.* at right angles to the femur was made. The cut *C.D.* does not go completely through the bone. The blade was detached and left *in situ* as a guide. A second blade was then inserted at *A.* and the cut *A.B.D.* made, thus freeing the quadrilateral section of bone *A.B.D.C.*, which was pushed out through the wound. Extension was then made, producing a green-stick fracture at the point *D.* The surface *D.B.* was forced against *C.D.* and the surface *A.B.* against the surface *C.E.* The projection *C.E.* prevents the possibility of a posterior dislocation. The knee was then immobilized in plaster and a firm bony union was obtained in six weeks. The great merit of the operation is its simplicity.

Dr. Lilienthal referred to the condition found in a boy, twelve years of age, who had been under his care. There had been a fracture of the lower end of the femur, with such great distortion and such complete retroposition of the condyles that the boy had a shortening of about four or four and a half inches at least. Dr. Lilienthal did an operation, similar to the one described by Dr. Lyle, and got a very perfect and beautiful result. The boy not only walks nicely, but he has good motion of the knee-joint of more than a right angle. Of course he didn't have any disease in the joint. The operation was most satisfactory. It is well thought out and it is simple of execution.

PAPER CLIP IN BRONCHUS FOR SEVENTEEN YEARS REMOVED BY SUPERIOR BRONCHOSCOPY

Dr. Edwin Beer presented a man, twenty-six years old, who gave the following history: Seventeen years ago, while playing with a paper-clip, it suddenly became lodged far back in his throat. His parent attempted to extract it with a spoon, but pushed it further down. Next day the patient was seized with paroxysms of coughing and raised a lot of mucus and blood. He had great difficulty in breathing. These symptoms gradually disappeared, only to become ill soon again with what was diagnosed as pneumonia. He was then in bed for about six weeks, but finally recovered, and remained well for about two years. From that time on he began to have pain in his right side and a hacking cough with copious expectoration. He was told that he had tuberculosis. Subsequently he was told that he had asthma. For these conditions he was treated for over twelve years, in numerous institutions, and by many physicians. Gradually his sputum became copious and more foul, and his general health began to suffer, so that he could not

work. He applied for admission to Bellevue Hospital, thinking he was a hopeless case of pulmonary tuberculosis, and on questioning immediately told of the accident with the paper-clip seventeen years ago. An X-ray of his chest, which shows the clip very clearly, confirmed the patient's history, and on July 15, 1915, under general and local anæsthesia, by the superior route, the clip was readily discovered in the lower right bronchus, and extracted with the bronchoscope. The patient made an uneventful recovery, and left the hospital four days later, relieved of his pain, and coughing and expectorating less.

A recent X-ray shows that the thickening in his lung is less marked, though considerable is still present. He still has some cough and some expectoration, undoubtedly due to the bronchiectasis induced by the presence of the clip in his lung for so many years.

NOTE.—The only other case in which a foreign body had remained in the lung for such a long period and was then removed by bronchoscopy, is that of C. Jackson, who removed a collar-button twenty-six years after aspiration.

DR. WILLY MEYER described the case of a young man in the early thirties, who had had typhoid fever years ago, and shortly afterwards began to suffer from difficult breathing; then he was better for a while, and lately he could not sit up without coughing. The greater part of the day he had to lie on his back. Bronchoscopy was done by Dr. Yankauer, who saw a foreign body in the bronchus. He extracted a piece of bone which on examination proved to be the necrotic cricoid cartilage.

The history showed that the man had had typhoid, had been extremely sick, delirious, unconscious, and evidently during that time he had developed a perichondritis, and the necrotic cricoid cartilage slipped into his bronchus. He had carried it there for fully twelve years. After extraction he was perfectly well.

DR. LILIENTHAL emphasized the advantages and the indispensability of bronchoscopy in all cases in which an atypical suppurative cough exists.

Only a few weeks ago he was called to see a young boy, about five years old, who had developed a peculiar hard, rasping cough which had continued for a number of days, and then developed flatness of the left chest, so that his physician thought he had an empyema. His temperature was running about 104½°, then he came down to normal for three days, and then had another exacerbation of temperature, and always with this sharp, ringing cough, which is quite characteristic.

An X-ray was made at the Mt. Sinai Hospital without definite result.

Dr. Yankauer then introduced a bronchoscope and found a water-melon seed in the child's trachea, which was easily extracted and a very prompt recovery made.

CARCINOMA OF THE NECK OF THE BLADDER AND PROSTATE

Dr. Edwin Beer presented a man fifty-eight years old, who since September, 1914, had suffered from increased frequency of urination accompanied by pain. He had one attack of hæmaturia.

January 26, 1915, cystoscopy showed bullous œdema around posterior circmference of neck of bladder, with extensive tumor formation on posterior wall and trigone.

Rectal examination showed a slightly enlarged prostate, and in median line just below junction of prostate and bladder a small, stony, hard mass. Another nodule somewhat larger was felt in the position of the right seminal vesicle.

January 27, 1915, he was subjected to a combined abdomino-perineal excision of bladder, perivesical connective tissue, seminal vesicles, lower ends of ureters, and prostate.

The patient made a satisfactory recovery, and is now presented almost ten months after operation, in excellent condition, without any signs of recurrence, and in spite of wearing permanent indwelling ureter tubes, he is free from any severe renal infection, and in comfort.

The pathological report was papillary carcinoma.

BENIGN STRICTURE OF ŒSOPHAGUS (ŒSOPHAGOSPASM'): TRANSTHORACIC EXPLORATION OF ŒSOPHAGUS

Dr. Howard Lilienthal presented a man fifty-four years old, who for a year had been growing weaker and had lost weight coincidently with gradually increasing difficulty in swallowing.

When first seen by Dr. Lilienthal, on October 8, 1914, even fluid was swallowed with difficulty. An X-ray by Dr. Jaches had demonstrated an almost complete stricture at the level of the third dorsal vertebra. The patient was emaciated but his general condition was still not bad.

On October 15, 1914, in the Private Pavilion of Mt. Sinai Hospital, he performed gastrostomy by Hall's method, in local anæsthesia. On opening the abdomen between the fibres of the left rectus an extremely mobile stomach was encountered, the pylorus being with ease drawn out of the incision. A cone of stomach near the greater curvature was pulled up from the wound and sutured at its base, all around to the peritoneum and posterior rectus. An opening was now made at the

apex of this cone into which a small catheter was sutured with catgut, and the cone with the catheter was inverted into the lumen of the stomach, the inverted cone being packed with gauze. A test as to the patency of the tube was made with water and a funnel. Two weeks later first dressing. Patient gradually gaining in weight. He was nourished by way of the fistula every two hours and rapidly gained; left the hospital on November 6, about three weeks after his gastrostomy.

Aware of the possibility that an inoperable carcinoma might be present, he had in mind the expedient of operating so as to connect the dilated œsophageal pouch with the gastric stoma by means of a rubber tube outside of the body, so as to enable him to swallow and so as to drain the œsophagus.

The patient gained in weight and early in December Dr. Jaches attempted to make a sausage-skin radiograph of the stricture so as to outline its limit. The sausage skin was drawn through from the œsophagus into the stomach by means of a silk thread previously swallowed and fished out of the gastrostomy opening. The sausage skin leaked, however, probably owing to the rapid digestion by the stomach juices. Later on a stronger string made of hog's gut was used, with the result that it was possible to obtain a satisfactory picture.

With the understanding of the patient and his friends that the operation might prove hazardous, but that amelioration would be in all probability impossible without it, he operated on December 10, 1914. With the aid of intratracheal anæsthesia by Dr. Branower and with the assistance of Dr. Martin W. Ware, he performed an exploratory thoracotomy and posterior mediastinotomy. The patient received one-third of a grain of morphine about an hour before the operation. The œsophageal pouch above the stricture was washed out. The seventh, sixth, fifth and fourth ribs were divided just beyond their articulation with the spine. The lower part of this incision was carried through the seventh interspace through the entire distance to the costal cartilage. Pleura at once opened and rib spreader put in. Exposure was excellent but the work was done very slowly. The left lung was found adherent at the apex, but the adhesions were cord-like in character and were easily divided between ligatures. The pleura over the mediastinum was now incised, and with the help of a stomach-tube in the œsophagus the gullet was easily recognized. Work here, however, had to be done very slowly, because he feared vagus manipulation with cardiac paralysis. One intercostal artery as it came from the aorta, probably the fourth, was divided between ligatures. No tumor was found, but the stricture was located without difficulty, using a good-sized stomach-

tube as a guide. The muscular coat of the œsophagus was comparatively little constricted, the conclusion then being reached that most of the trouble was in the mucous lining. From the fact that the man had been ill for more than a year, they concluded that no malignant tumor existed. An attempt was now made to put in a fine urethral instrument under the guidance of the eye and with the aid of the fingers in the thorax, but this was impossible. The prognosis, however, being good in the absence of cancer, provided the patient should recover from this large operation, nothing more was now done. The large incision was closed with catgut through the muscles and silk through the skin. A few chromic catgut sutures were placed in the intercostal incision by the pericostal method. Entire wound closed without drainage, the lung being fully distended at the time of the completion of the suture.

On examining the history chart after the operation it was found that this patient had had 103 degrees of fever the night before the operation, which fact the house officers had not told the surgeon.

At the end of the operation, which had taken two hours, there appeared to be a considerable shock, but a sharp reaction to 104 degrees was followed by a drop to the neighborhood of 100 degrees. Next day the patient was in excellent condition.

Three days after the operation the patient was sitting up out of bed. At the first dressing on the sixth day the wound was found healed by primary union. The temperature remained under 101 degrees, pulse of good quality and rarely faster than 112.

The string was now again swallowed and gradual dilatation practised with tubes of various sizes, drawn from the mouth to the stomach, until the largest size stomach-tube could be passed with the greatest ease.

On January 1, 1915, the patient was discharged from the hospital, still wearing the string. The dilatation was kept up about twice a week. He could swallow solid food perfectly, and except for the presence of the string, which annoyed him, he was comfortable. Some weeks later he began dilating with the Plummer instrument, and finally, at the urgent insistence of the patient, the string was removed. The patient was advised not to let the gastrostomy wound close, but he felt so well that he neglected the precaution of keeping it open, and it promptly healed. For a time Dr. Lilienthal was able to dilate with the Plummer instrument almost to its full size, but it became very difficult to avoid the pouch in the œsophagus. Some days the instrument passed without the slightest difficulty; at other times it was quite impossible to insert it. The man now eats food of all kinds and has no difficulty in swallowing. Still there are signs of stasis in the pouch and he now

washes it out every day to prevent decomposing food from settling therein. If signs of stricture recur it will probably be necessary to make another gastrostomy and dilate. Perhaps had there been a string in the stomach at the time of operation something could have been done to straighten out the kink, but this is problematical. The final diagnosis is spastic stricture of the œsophagus. The case is here presented as an example of Torek's thoracotomy and Dr. Lilienthal can testify to the comparative simplicity and to the adequacy of exposure which this method affords. He had since used it in another case, in which extirpation of a cancer of the thoracic œsophagus was performed, the patient dying two days later of acute infection. This case will be reported in full elsewhere.

It is interesting to note, however, that in this second case the entire operation was performed with intrapharyngeal anæsthesia instead of intratracheal. There were some veil-like adhesions in the chest which may have added to the safety of this form of anæsthesia by keeping the mediastinum partly supported, but in other cases the intrapharyngeal method has been so satisfactory that I have adopted it as a routine. It is perfectly possible to collapse or expand the lungs by this method and there is also the great advantage that the lung on the side which is being operated upon can be collapsed without interfering with the expansion of the opposite lung. This is an enormous advantage of the intrapharyngeal method of differential pressure.

Dr. Willy Meyer said that all the cases of thoracotomy which had been done at the German Hospital without opening the œsophagus were successful. Even where they worked for some time in the thorax, as long as they did not try to open the œsophagus, every one was a success. In other words, exploratory thoracotomy without opening the œsophagus is a safe operation, but as soon as one interferes with the lumen of the œsophagus, then trouble comes in. In all such cases drainage should be used.

BULLET WOUND OF KNEE

Dr. Karl Connell presented a boy, fifteen years old, who had been shot in the knee three months previously. The bullet was from a .38-calibre revolver at a distance of three yards, penetrating the left knee-joint. The missile entered lateral to, and above, the patella, traversed the outer condyle of the femur upward and backward, and lodged in the lower fourth of the shaft of the femur.

On admission to the Roosevelt Hospital, service of Dr. Charles H. Peck, two hours after the injury, the boy's knee-joint was distended

with blood and exudate. Dr. Connell opened the joint twenty-four hours after injury by five vertical incisions, exposing freely the superior, the two lateral and the two posterior main pouches of the joint. These pouches were irrigated with weak iodine solution. The wounds were then closed without drainage by loose suture of the skin.

The bullet itself was removed by separate incision, lifting the popliteal structures from the femur and chiselling a block from the shaft of the bone. The bullet was deformed and presented fibres of woollen cloth on its nose. This latter wound was packed wide open.

There was moderate constitutional reaction, but the temperature remained normal after the fifth day. On the sixth and eighth day several of the wounds into the knee were probed open by phenol swab, to release a small pocket of turbid synovial fluid collecting in the subcutaneous tissue. On the tenth day all the wounds into the joint had healed. The incision to the bed of the bullet, however, developed a putrefactive infection, such as is commonly seen with the low velocity débris-laden shrapnel bullets of Europe. However, this infection remained local and the joint itself remained uninfected. This wound healed in about eight weeks without discharge of any bony sequestrum.

Joint movement is now painless, the boy walks without limp, the traumatic synovitis has gradually subsided, and the knee flexes past the right angle.

Dr. Connell stated that the case was presented to exemplify a distressing type of injury commonly observed in his experience through the past winter in the war zone of France and the Central Empires. The case further exemplifies the wisdom of early and radical surgical cleansing of the knee-joint in wounds inflicted by low velocity débris-laden missiles.

KNEE-JOINT PERFORATED BY RUSTY NAIL

Dr. Connell presented a second case of knee-joint injury, a medical student twenty-one years old. Fifteen years previously he had fallen on a rusty nail, which penetrated to the outer side and below the patella. That night the knee ached and became stiff.

On admission to the service of Dr. W. T. Bull at the New York Hospital the next day, the knee-joint was distended, tender, and of increased heat. Two days after injury the joint was aspirated by Dr. W. C. Clarke, and injected with 1 per cent. aqueous phenol solution. Two days later it was again aspirated and injected. The first aspiration showed the staphylococcus albus in culture.

On the seventh day the inflammation had markedly subsided and

the knee continued to improve without further surgical interference. The knee-joint of this patient presents to-day no limitation of function. It exemplifies a type of mild infection yielding to minor surgical interference.

DR. CONNELL presented a third case of knee-joint injury, a woman forty-eight years of age. Eight months ago, while in a dentist chair, the patient was struck by a dental probe, which imbedded itself in the thigh, two inches above the patella. The probe was easily withdrawn. Eight days later the wound became reddened and the knee-joint gradually became sore and stiff. Two weeks after the injury the patient entered the Roosevelt Hospital; the knee-joint was moderately painful and was held rigidly; it was slightly tender and moderately distended. The wound above the patella was suppurating and was opened into the subcutaneous tissue. The joint was aspirated of turbid fluid which showed on culture the staphylococcus aureus in one of two culture flasks. It was supposed that one flask might have been contaminated. The joint was immobilized without further surgical interference. One month later the condition had not improved, the patient had lost weight, and had become slightly septic. The joint was therefore aspirated of turbid fluid, which showed many staphylococci. It was injected with Lugol's solution of iodine. Moderate constitutional and local reaction followed and the joint fluid became more frankly purulent. Further aspiration and injection failed to control the process, and two months after the injury the upper and lateral pouches were drained. After several weeks of imperfect drainage, the patient fell into a low delirium. The joint was therefore opened completely by transverse incision across the patella, and dressed wide open in acute flexion.

Suppuration extended beneath the quadriceps extensor muscles and necessitated multiple incisions to the upper third of the thigh. The constitutional sepsis subsided in about six weeks, when the joint was again extended fully by continuous traction. Flexion recurred after several months. Therefore, the joint was resected. It is now ankylosed and healed except for several small sinuses.

The acutely flexed position in this case presented the usual mechanical difficulties of retention, and of again securing extension of the joint, with no commensurate advantage of drainage over the transverse drainage incision with the joint left in full extension.

A fourth case of knee-joint injury was presented: a man who had sustained a small wound by broken glass over the knee-joint several months previously. The wound was sutured the day of injury without drainage. Two weeks later he presented himself at the Roosevelt

Hospital with an extensive cellulitis over the knee-joint and suppurating hæmarthrosis of the joint. The joint was widely drained by multiple incisions. The case passed through the usual two months of profound sepsis and four months of slow repair. The leg is now in good position, slightly flexed, and the joint is ankylosed.

Dr. A. G. Gerster said that he had seen perhaps fifteen or eighteen cases of traumatic infection of the knee-joint.

There was one traumatism which was most interesting, caused by an old-fashioned surgeon who put a seton through one of the periarticular bursæ on the inner side of the knee-joint, which ordinarily communicate with the joint. In drawing that seton through this bursa every day, or every other day, an infection of the bursa occurred which affected the knee-joint. This happened in a woman who was suffering from diabetes, and you know how the case ended.

Now, then, in going back to the presentation of the subject from the pathological aspect, the doctor had correctly classified the subject into, first, those cases in which a mild infection involves the inner line of the joint; that is, the synovial membrane. Then he went on to the cases that are more severe, where there is a sepsis that is not local, but also affects the general condition of the patient; and, finally, he came to the so-called gangrene cases, which, as the doctor states, are very rare in civil practice but very common in war practice.

There is one more class which the doctor hasn't mentioned, and the existence of which was demonstrated frequently after we adopted Mayo's method of treating these knee-joints. In adopting the Mayo treatment in very severe cases, it was found that there is a form of infection which does not affect alone the synovial lining but also infects the layer of connective tissue, which is situated between the synovial membrane and the capsule, a layer which is not uniform everywhere, which is very thin in some localities and rather massive in others, and in this layer a phlegmon will develop such as will develop in phlegmons on the palm of the hand.

It is plain that irrigation of such a joint will give no benefit whatever, and the patient will succumb to long suppuration and the detachment and extrusion of the necrosed material. In these cases, undoubtedly the free exposure of the joint is the proper thing to do.

Dr. H. H. M. Lyle said that during the Spanish-American War in Cuba there were seventeen gunshot wounds of the knee. In Juilly, France, they had fifty joint cases (exclusive of joints of foot and hand); twenty-three of these were wounds of the knee, with one death and two amputations. The wounds of the knee fall into three distinct classes:

1. Wounds of the knee-joint without damage to the bone. 2. Wounds of neighboring structure with fractures leading to the bone. 3. Wounds of the joint with damage to the articular bones.

Dr. Lyle said that prompt operative interference was imperative in all penetrating wounds of the knee-joint which showed the presence of a foreign body. There are no exceptions to this rule. Prompt operative interference is also necessary in all perforating wounds of the knee-joint caused by shrapnel and shell fragments, even if the missiles have not lodged. Shrapnel and shell carry foreign bodies into the joint, consequently all such wounds are to be regarded as potentially infected; on the other hand, perforating bullet wounds often remain aseptic, and can be treated conservatively.

The type of operative interference should depend on the condition. For the early and simple case bilateral arthrotomy, disinfection of joint, removal of the foreign bodies, with the application of an embalming dressing. If the foreign bodies could not be removed from the joint by bilateral arthrotomy, or if this procedure was insufficient, or if the patella was already fractured, a transverse arthrotomy by cutting across the patella tendon was performed. Next in order came a resection. Tuffier is an advocate of resection to save amputation. The indications for an immediate amputation are extremely rare. Indications for a late amputation should be uncommon and only occur in neglected cases.

As to the details of treatment, infinite care and patience were required to obtain good results. Immobilization combined with traction gave relief and made the dressings much more comfortable. Types of splints used were the Blake, Mauclaire's fenestrated plaster, and the Steinman pin in combination with the Juilly splint. Drainage was established by large well-placed incisions and rubber dam; no rubber tubes were used.

The importance of the after-treatment of these cases could not be overestimated and massage and movements should be directed by the surgeon himself. If an ankylosis was expected, the knee was placed in a slight degree of flexion; hyperextension should be avoided; on the other hand, if motion was expected, the knee was placed in a position of hyperextension, because it was found that walking on a partly flexed joint was painful and set up articular trouble.

Dr. Connell, in closing, stated with reference to the treatment of septic arthritis of the knee-joint, that his experience in the European war zone was all against early resection. He had observed several cases, which after early resection developed a violent osteomyelitis of the femur. One of these cases died and another came to amputation at

the knee-joint. These joints had been resected before the infection had entirely cooled down, and the bone had reacted deeply into its interior, as it does after some months of joint suppuration. Thus, by resection, free portal had been given to extension of infection. Other cases of early resection were cited which had not terminated so disastrously, yet in which the pouches suppurated as persistently and the process as a whole took as long to heal as in those cases where no resection had been done. Therefore, resection should be reserved to a late date, at least several months after the original infection. Resection might then serve some definite mechanical purpose, such as correcting position, or inducing ankylosis; it should not be performed for the purpose of securing drainage.

Stated Meeting, held November 24, 1915

The President, Dr. Chas. N. Dowd, in the Chair

THROMBO-ANGIITIS OBLITERANS

Dr. Frederick T. Van Beuren presented a man, thirty years of age, who had been admitted to Roosevelt Hospital to the service of Dr. Hotchkiss on July 7, 1914. Sometime during the preceding winter he thought that he had frozen his left great toe. He paid but little attention to it at the time. Three months before his admission he noticed a little crack on this same toe, which he picked open with his finger nail. Since that time he had had considerable pain in the toe and the small crack had become a large ulcer (Fig. 1). The pain had been continuous, worse at night, often keeping him awake, and was aggravated by raising the leg to a horizontal position and alleviated by hanging it down. When he lay down and straightened out his legs he felt a throbbing behind his knees. For the previous three months he had had to sleep with his left leg over the edge of the bed. He had had to quit work because he could not stand for long without pain, and he could not walk more than a block or two without severe pain in the calf. His general health was good; he had always been well in the past. His appetite was good and his bowels regular. He denied venereal infection; drank a little beer, and never smoked more than ten cigarettes a day. His family history was negative. On physical examination he appeared well nourished and in good general condition, but walked with a limp (using a cane). His face showed an expression of pain and anxiety. The examination of his eyes, ears, throat and chest and abdomen was negative. His teeth were in poor condition and his gums exhibited marked pyorrhœa alveolaris. His superficial inguinal lymph-nodes were readily palpable and his

FIG. 1.—Ulcer of toe from thrombo-angiitis obliterans.

extremities were otherwise negative, except for the following surgical condition: The left leg was slightly œdematous from the knee downwards. All the toes and the adjacent metatarsal region were a purplish red in color, in marked contrast to the other foot, but not cold and not tender, except for the great toe, which was moderately swollen and extremely tender in the region of a superficial, indolent ulcer 1½ cm. in diameter, with a sloughy base and a rather calloused margin, which occupied the mesial aspect of the base of the proximal phalanx. Pulsation could not be felt in the posterior tibial, anterior tibial or the dorsalis pedis arteries. His urine was normal; temperature, 98°; pulse, 72; respiration, 20. Wassermann was negative. During the first six days he was kept in bed as much as possible and the leg and foot were baked and massaged for one hour each day. He had so much pain, however, that he begged to be allowed to sit in a chair. He sat up for the first two nights with almost no sleep and got very little the third night from a grain of codeine. His discomfort was so great, and other treatment had proved so unavailing, that it seemed justifiable to try the femoral ligation for impeding the return circulation, as suggested by Hesse and Oppel and as carried out by Lilienthal, who reported four cases at a meeting of the Surgical Society last winter, with marked alleviation of the pain in three. So after explaining to the patient that the procedure was in some sort experimental and that no absolute cure could be promised, but that relief from pain was probable, the operation was decided on. July 14, 1914, under ether anæsthesia, a 3½-inch incision was made in the left groin, which gave easy access to the vessels, and the femoral vein was occluded by two No. 3 chromic gut ligatures, 1 inch apart, the lower being just above the entrance of the internal saphenous vein. No immediate disturbance was noted and no untoward symptoms ensued. The sheath of the vessels was united with plain gut and the skin closed with silk. On removing the covering from the leg at the close of the operation, moderate duskiness of the leg was noted below the knee. One and one-half hours later œdema and duskiness of the toes were accentuated. He was put to bed with the foot slightly elevated and external heat applied. That night his pain was severe and he required a hypodermic of morphine. The next day he had moderate pain in the toe and there was a bleb 1 × 3 cm. noted on the dorsum of his foot (possibly due to external heat), but the duskiness of the leg had nearly disappeared and the circulation of the toes, which were still pretty red, returned fairly rapidly when pressed out.

For the next ten days his progress was favorable. He had no further pain; the œdema of the leg and foot almost disappeared, and the toes

were much less red. The tenderness around the ulcer disappeared, but the ulcer did not heal. On the twelfth day after operation he had to have codeine. When he left the hospital on July 30 the swelling of his foot had returned, the ulcer of the toe had slightly lessened in size, and the bleb on the dorsum of his foot had broken, leaving thin epithelium exposed. Wound in groin healed by primary union, but there was some œdema of inner part of thigh in upper third and below this region some tenderness on pressure. Patient said that he felt better than before the operation, but not nearly so well as during the past week.

During the next month he was treated in the out-patient department by baking and massage, and after a couple of weeks noticed a distinct lessening of the pain. This improvement continued for several months, and he again became able to sleep with his leg in a horizontal position; was able to walk more than a quarter of a mile without pain, and his outlook upon life has become more cheerful. As his treatment before and after operation have been the same, it is perhaps fair to believe that some of the improvement has been due to the operation itself.

November 6, 1914. Both ulcers had entirely healed about two weeks before. For the past four weeks his treatment had been baking and dermatol powder on the ulcers and a clean white stocking every morning (without a bandage). The sock is washed and boiled every day.

July 26, 1915. General appearance much better. No œdema of leg. Dilatation of internal saphenous in scar. Color and circulation of foot much better. No blueness. Ulcer is much larger and deeper. Toe tender all around it.

October, 1915. Pain continues and ulcer shows no tendency to heal.

November 22, 1915. Pain continues. Ulcer 1¼ × 1½ inches.

Dr. Alexis Moschcowitz said that this disease does not occur exclusively in Jews, as is frequently seen in literature, because it has also been described in Japanese and in Turks.

A short while ago a paper was read upon the conservative treatment of these cases before the Surgical Section of the Academy. A large number of different methods of treatment have been described. He had had no success with any of them, and he had tried all of them faithfully.

Although he had made it a rule when he got these cases to hint at an amputation, he fought off amputation as long as possible. When he decided that an amputation was the only thing that can do the patient good, he did not amputate peripherally. The Moschcowitz test is undoubtedly known to all, and it had never failed him wherever he had followed the test; healing at least has always been good, and the patient discharged in the shortest possible space of time.

When, however, for reasons which appeared at the time to be good and valid, he had amputated contrary to the Moschcowitz test, he had always had occasion to regret it, because ultimately the case came to a second amputation at a higher level.

Dr. Seth W. Milliken said there is a patient at the Lincoln Hospital who has been there now for nearly a year, a colored man who has had his right leg amputated at several levels, finally just below the knee through the tubercle of tibia. The left leg subsequently began to bother him in the same way with ulcers forming on the sole of the foot and then on the front of the ankle, and it was amputated primarily through the tubercle tibia. The first stump did heal and remained healed for several months. The left stump never healed and the ulcer area has gradually increased. His condition varies from extreme pain to moderate discomfort. His Wassermann reaction has been positive but antisyphilitic treatment has no effect on the local condition.

BRANCHIAL FISTULA

Dr. Chas. N. Dowd showed a patient upon whom he had operated for complete branchial fistula (see vol. lxiii, p. 519).

Dr. Dowd showed another patient who had had complete branchiogenic fistula which had been operated upon by another surgeon nearly four years ago. The sinus wall had been dissected away as far as possible, apparently close to the carotid bifurcation, and the remnant was ligatured. There had been no recurrence for more than three years; an abscess had been formed behind the incision scar. He had opened this abscess recently, but could not find that portion of the fistula which led from the abscess cavity to the pharynx. He was keeping the incision open in the hope that a sinus would form which could be dissected to its pharyngeal opening. Methylene blue solution injected into the abscess opening now showed very faintly in the mouth, but a probe would not follow the same route.

FRACTURE OF ANATOMICAL NECK OF HUMERUS

Dr. Frank S. Mathews presented a man who was in an automobile accident five weeks before he first saw him, fell, striking on his right shoulder. On the same day he was put under an anæsthetic, and it was decided that he had a dislocation of the shoulder. Reduction was supposed to have been made and the arm was put up in a dressing.

At the end of four weeks, when the dressing was removed, it was discovered that it had not been reduced, and another effort was made under an anæsthetic to reduce the dislocation. This was not successful

either and he was sent to St. Luke's Hospital. An X-ray picture showed that he had a fracture of the anatomical neck of the bone with dislocation into axilla. The head of the bone was unusually low. The head could be felt through the skin of the axilla, and of course it was easy enough to see that the head of the bone was absent from its normal situation.

The nearness of the head of the bone to the floor of the axilla made it very tempting to approach it in that way, and an incision was made in the axilla, first dissecting out a considerable amount of fat so that the nerves and vessels could be seen. The articular face of the bone was turned toward the vessels. One could see the flattening of the axillary artery. The dissection was then carried upward, following as close as possible to the subcapsular muscle, to get at the bone from behind. After very long and very careful dissection he was able to get the head out.

He had musculospiral paralysis and more or less weakness in the distribution of some of the other nerves. The musculospiral paralysis in the four weeks has pretty largely disappeared.

The head of the bone lay in a very dense capsule. The fibrous layer was fully an eighth of an inch in thickness.

BONE TRANSPLANTATION FOR SARCOMA OF THE HUMERUS

Dr. Chas. A. Elsberg presented a patient from whom he had removed a sarcoma of the head and upper end of the humerus, and had transplanted a piece of the patient's fibula. The head and about two inches of the shaft of the humerus were removed and the upper five inches of the fibula were removed and implanted into the stump of the humerus. Pathological examination showed that the tumor was a round-cell sarcoma. The patient was an eye specialist and now, after five and one-half months, he had been able to perform various operations, such as extraction of cataract, with that arm. The good result was doubtless due to the fact that the operator was careful to isolate the tendons of the infraspinous and teres minor and to sew them to the periosteum of the upper end of the fibula. X-rays show that the new head has remained in contact with the glenoid cavity. X-rays made one month, two months and four and one-half months after the operation show a gradual deposit of new bone around the transplanted fragment. During the last six weeks the bone deposit has been gradually increased, and during this period he has been gaining more and more power in the limb. At present he can abduct the arm to the horizontal. The head

of the fibula has gradually become rounded and the X-ray shows very beautifully a new head more or less rounded like that of the normal humerus.

Stated Meeting, held March 8, 1916

The President, Dr. Charles N. Dowd, in the Chair

ACUTE POST-OPERATIVE DILATATION OF THE STOMACH

Dr. Burton J. Lee read a paper with the above title, for which see vol. lxiii, page 418.

Dr. George Woolsey referred to a case of gall-stones in which the pain had been so very intense that morphine didn't relieve it, so that he had taken a good deal of chloroform for two days before the operation. The operation was not particularly difficult.

Two days later he was enormously distended, and on washing his stomach out, or passing the stomach tube, this was relieved. Treatment by lavage and frequent changes to the prone posture was ordered.

The man recovered, and a striking feature of the case was that when, three or four weeks later, he came down to the city before going off on a trip, he was exceedingly emaciated. He looked like a man who had been through a long typhoid, and it seemed as if there must be some toxic element to account for his extreme emaciation. Dr. Woolsey said that he had treated other similar cases by postural treatment, as well as the stomach tube, and had felt quite convinced that the prone posture had a very beneficial effect.

He thought the explanation of the swallowing of air to be the only one that can be accepted. He could not understand how the production of gas can occur otherwise. He could understand, too, how a dilated stomach will push down the small intestines into the pelvis so as to perhaps cause some pressure upon the duodenum by traction on the root of the mesentery, but this, of course, is secondary. He could not understand how the removal of that pressure on the duodenum is going to relieve the dilated stomach.

The explanation is rather that of regurgitation of gas through the œsophagus.

Dr. John A. Hartwell thought that the acute dilatation of the stomach is a secondary condition, due to some entirely unknown factor. It is not an anæsthetic condition, because it has been reported in many cases where no anæsthetic has been administered. It has occurred quite

frequently in the application of plaster jackets for spinal trouble in the child or adult, in the suspended position. It has been reported in one or two cases where a local anæsthetic has been used, and so the general anæsthetic apparently has nothing to do with it. It is not produced experimentally by tying either the pylorus or the duodenum at the jejunal angle. This they had done many times in their intestinal obstruction work and no gastric dilatation ever resulted, except after several days, a chronic condition..

The contents of the stomach is usually gas, as Dr. Lee has pointed out; that is, at first, but it may quite rapidly be followed with the fluid secretion. He had seen four cases within the last two years—all under quite different circumstances; three of them very marked, one fatal, and the fourth one moderate.

The first one was an actual case of operative acute dilatation of the stomach, occurring during operation on the biliary tract, in which the stomach, about half-way through the operation, began to dilate, and so rapidly and extensively that it was impossible to continue with the operation until the stomach tube was passed. Even when the stomach tube was in the stomach, there was not sufficient pressure to expel the gas from the stomach. It had to be taken into the hands and pressed upon, when great quantities of gas would bubble out through the tube and the stomach would be collapsed, but in the course of a few minutes it would fill up again. It did not occur after the operation, and the patient did not suffer.

The second case was that of a child who had received an injury, being struck with an automobile in the lower part of the chest, more particularly on the right side. It was brought into the hospital in a condition of moderate shock, and upon examination the abdomen was seen to be slightly distended, but not markedly so. In half or three-quarters of an hour the abdomen had distended some eight or ten inches in circumference. Under treatment, the air was finally expelled, and within ten hours the child was entirely recovered. But that stomach dilated directly under our eyes at a perfectly enormous rate.

The third case was under the care of Dr. Bulkley, in the Cornell division of Bellevue. A boy who had been run over suffered rupture of the spleen. He was brought into the hospital about five o'clock in the afternoon, and the diagnosis was made. It was noted at the time, less than two hours after his injury, that his abdomen was becoming rapidly distended, particularly in the upper part.

Dr. Bulkley operated on him. On opening the abdomen the stomach was seen to be much dilated, and it dilated so rapidly that it was impos-

sible to get it out of the way, and the child died before the operation was completed.

The fourth case was rather unique. It was that of a man fifty-one years old, who had been out of work for eight weeks, and during that time had had scarcely anything to eat, and he was nearly starved. On the day before admission to the hospital he had been given fifty cents, and he had filled himself up with the heaviest, coarsest food he could get, and of course he bolted it down.

In a few moments after that he had intense abdominal pain. He came to the hospital on the following day, presenting the appearance of a man just about to die. Upon examination, it was found that he had an enormously distended abdomen. He had been vomiting enormous quantities of dark brown, bilious material.

A stomach tube was passed and there was a gush of this same kind of material, until four and a half quarts had issued and the entire distention had disappeared. There was nothing else whatever the matter, and in a couple of days he was entirely recovered.

That was a dilatation not quite so acute, though it had come on immediately after he had taken his meal, and had continued progressively during the intervening hours.

In only one of these cases did there seem to be any marked evidence of a toxic condition such as Dr. Lee had mentioned. In that last case the man looked desperately ill and seemed to be poisoned. The child that was run over seemed to be shocked by his injury, but he didn't look toxic. The patient that showed a partial dilatation on the table showed no evidence of a toxic condition.

There is no doubt that if a sufficient dilatation of any of the viscera occurs, a very serious toxic condition results from that. But in acute dilatation it takes place in such a short time that it is hardly possible that they are poisoned by this condition. The evidence that Dr. Lee gives, and other evidence he had seen, seemed to him to rather strongly point to the condition as a secondary one, due to some entirely unknown cause, but brought about indirectly by very many conditions that are in no way associated one with the other.

Dr. Joseph Wiener had had one or two cases of postoperative dilatation of the stomach in gall-bladder cases. One of them was a lady, fifty-eight years old, who had a violent postoperative dilatation for four days, and on the fifth day, fortunately, she mended and got well. About two months ago he had occasion to operate on this same person again, and she was mortally afraid she was going to get another acute dilatation of the stomach, but she did not.

It did not seem to him that the mere swallowing of air would explain the condition entirely, because why do so many of our abdominal cases get it when our other cases do not? A very large proportion of the cases reported this evening have been intra-abdominal cases. A large number of these cases have had intra-abdominal manipulation.

Personally, he believed there is a paresis of the stomach, besides some other factor.

DR. CHARLES HENDEE SMITH thought that acute dilatation of the stomach was not due to toxæmia, reflex action or anything else except a mere matter of air swallowing, or a forcing of air into the stomach through the œsophagus in one way or another. It is perfectly easy to explain that with a conscious patient. The pharynx is so constructed that it cannot contract down on a small amount of food. When the food is solid and goes down in a bolus it fills the pharynx. When the food is liquid, it only partially fills the pharynx, and the pharynx forces air with each small amount of liquid down into the stomach through the œsophagus. The pictures showed that where there is fluid in the stomach it forms a perfect water-lock and prevents the eructation of air when the patient is in the supine position.

The pre-operative cases of distention he would explain simply as due to the nervous swallowing of a patient waiting for an anæsthetic. It is a very nervous time for almost everybody, and we all know that the secretions of the mouth are increased tremendously by any nervous excitement. Some patients simply lie and swallow saliva and air for some time before taking the anæsthetic. Fermentation can not produce gas at so rapid a rate. It must be swallowed air. The pre-operative cases are explainable in the same way, as the air can not escape unless the patient is raised to a semi-erect position. Under deep anæsthesia there must be some other factor, although it is the same mechanism; it is a forcing of air down by the respiratory movements. Everybody who has given an anæsthetic has heard the patient make a gulping sound with each respiratory movement. It is the same kind of a noise a baby makes in taking a bottle. Not all patients do it. There must be some peculiarity about the stomach, whereby there is a valve-action. The diaphragm in descending forces a little air into the stomach and the air is unable to escape. There must be marked atony of the stomach, which allows the stomach to dilate to the extreme degree seen in some cases. Probably there is a moderate distention from these causes in many other cases.

DR. LEON T. LEWALD suggested making a practical application of the negative pressure or aspiration principle to cases of dilatation of the

stomach which do not readily respond to the simple passage of a stomach tube or lavage. Dr. Hartwell had just mentioned such a case, in which he had accomplished expulsion of the air by means of direct compression of the stomach. A carefully applied slight degree of negative pressure would produce the same result more promptly and efficaciously. It might be wise to construct a special tube for this purpose, having a number of very small sieve-like openings at the end, in order not to suck the mucous membrane into the tube.

Dr. LeWald had applied this method to cause the collapse of a dilated colon. Dr. Downes was operating on a case of megacolon, and asked him to pass a tube into the rectum. This was done, but no gas escaped, although the tube was a very large and rigid one, and Dr. Downes with his hand in the abdomen could feel the end of the tube free in the colon. Dr. LeWald begged permission to attach the suction apparatus. When this was done the colon immediately collapsed and remained so. Dr. LeWald suggested that the repeated application of negative pressure to a tube in the rectum might offer hope of some permanent relief in megacolon. The same principle would be applicable to cases of acute or chronic dilatation of the stomach.

He believed the mechanism of dilatation of the stomach to be a relaxation or inhibition of the normal tonic contraction of the organ, due to some toxic condition or a reflex nervous manifestation, as suggested by Dr. Douglas. He had seen one case as a toxic fatal complication of measles and bronchopneumonia in a young soldier. The relaxed stomach acted somewhat like a bellows, and thus encouraged the entrance of air from the œsophagus, as suggested by Dr. Smith; but that, owing to the lack of muscular tonicity, it failed to expel the accumulated air.

Dr. LeWald was much interested in the relationship of suppression of urine associated with acute dilatation of the stomach. He had observed a marked dilatation of the colon in several cases of ureteral colic which he had röntgenographed during the attack. Some reflex mechanism apparently allowed the colon to dilate in association with a partial suppression of urine due to a blocking of a ureter by a calculus. In some way the suppression of urine and the somewhat analogous condition to the dilatation of the colon—namely, the dilatation of the stomach—might be associated.

He believed that the Röntgen ray would afford a means of diagnosis in doubtful cases of acute dilatation of the stomach, for, even *without* the administration of any opaque substance, the dilated stomach could be distinguished from dilated small intestine or colon by means of its air content.

ACUTE POSTOPERATIVE DILATATION OF THE STOMACH FOLLOWING CHOLECYSTOTOMY; SUPPRESSION OF URINE; RECOVERY

DR. BURTON J. LEE presented a man, forty-two years of age, who had been operated upon in September, 1910. A simple cholecystotomy was done under gas and ether anæsthesia, with the removal of several stones from an inflamed gall-bladder. The man's condition was good throughout the operation, which was uncomplicated and not prolonged. Urine examination before operation showed specific gravity of 1020, with 25 per cent. albumen, with some pus sediment and a few casts.

During the first twenty-four hours no urine was voided, and by catheter but four drachms had been drawn. At the end of thirty-six hours there was still no additional urine. Urine examination at this time showed specific gravity of 1020, with 50 per cent. albumen, some pus sediment and a few casts. The patient was belching a good deal of gas, had a very uncomfortable hiccough and complained of marked exhaustion. The abdomen was considerably distended, and one could definitely make out the stomach by percussion to nearly the level of the umbilicus, but no definite projection of the stomach against the anterior wall could be seen. Vomiting then began, large amounts of dark brown fluid being regurgitated. The pulse became a little more rapid and it was quite evident that the man was suffering from acute postoperative dilatation of the stomach. Saline given by rectum was retained. A hot pack was applied and later colon irrigations were used. At the end of the second twenty-four hours three and one-half ounces of urine had been voided. Vomiting continued throughout this day, associated with hiccough and very marked exhaustion. Under lavage and postural treatment, with frequent colon irrigations and hot packs, the patient's condition gradually improved and vomiting ceased. Urine increased in amount and on the third postoperative day sixteen ounces of urine were passed. Urine examination showed only faint traces of albumen.

On the fourth postoperative day seventy-one ounces of urine were obtained and the urine soon returned to normal. Recovery was uneventful.

PARTIAL ENTEROSTOMY DUE TO A BAND; SUBSEQUENT ILEO-COLOSTOMY

DR. BURTON J. LEE presented a woman, forty-two years of age, who was brought to New York Hospital December 11, 1915, with the following history:

Chief complaints were acute abdominal pain and persistent vomiting. On the day of admission she awakened feeling nauseated, and through-

out that day had considerable discomfort in her abdomen. At four o'clock she was suddenly seized with violent abdominal cramps, located chiefly in the epigastrium. These were somewhat relieved by lying on her left side with her knees drawn up. Shortly afterward she fainted. Vomiting began immediately and continued without intermission until her entrance into the hospital. Patient remembered nothing since the initial symptoms, save that her bowels moved twice in the morning. She had always been markedly constipated.

Physical examination showed a poorly developed, poorly nourished, anæmic woman. She looked extremely ill and was in collapse, with skin cold and clammy. Tongue was coated; breath foul but not fecal. Patient seemed to be suffering from acute abdominal pain. Abdomen was generally tender and rigid, particularly in the epigastrium and to the left of the epigastrium. Above and to the left of the umbilicus was an indefinite sense of a mass. The abdomen was moderately distended; no signs of free fluid. The patient was tossing wildly about the bed and could not be made to answer any question intelligently. Blood count, 32,200; 92 per cent. polymorphonuclears; temperature, 94.2°; pulse, 96; respiration, 24.

The abdomen was opened immediately by a median incision from the ensiform to the umbilicus. Stomach was negative. Gall-bladder was thickened and inflamed, and full of numerous large stones, but not perforated. It was not disturbed. A mass was felt in the middle of the abdomen and proved to be a gangrenous ileum, strangulated by a band from the left overy crossing the root of the mesentery to the posterior abdominal wall, near the ileocæcal junction. The gangrenous gut measured about seven feet, and constituted about one-third of the small intestine. The mesentery was also gangrenous. The gangrenous ileum and mesentery were resected and the two open loops of small bowel were brought out through the wound and a Paul's tube placed in either loop. Time of operation thirty-five minutes. Recovery satisfactory.

On the third postoperative day an end-to-end union with a Murphy button was done with a purse-string of Pagenstecher. There was some tension of the lower portion of the ileum and some difficulty was experienced in placing the button. Recovery satisfactory.

Four days after the second operation fecal leakage appeared, and the following day a third operation was performed. The whole wound area was bathed in fæces and pus. The button was exposed and removed from the depth of the wound. The stump of the ileum, two inches long, was freed and inverted with a double purse-string of chromic gut. The

upper end of the ileum was freshened down to healthy tissue and an end-to-side ileocolostomy was performed, two rows behind and two in front, the outer layer being silk. Closure fairly satisfactory, but some leakage was expected. Patient's condition, however, did not warrant a more prolonged operation.

Five days after the third operation some fecal discharge began, but this gradually lessened and disappeared about a week later. The problem of feeding the patient was a difficult one and was undertaken by Dr. Foster. Her complaints were persistent diarrhœa, marked rectal tenesmus and burning in the rectum. It was impossible at first to get in more than a few hundred calories a day. Opium was given at frequent intervals. For a considerable period koumiss was the sole food. There has been a steady improvement, the daily calories now reaching 2000. The intestines have adjusted themselves to the new condition, so that now the patient has but from two to four semi-formed movements per day. She has gained in weight and is rapidly convalescing.

An examination of the stool, made March 7 by Dr. Stillman, gave the following result: Reaction was alkaline; microscopically there were a few meat fibres, but not more than are normally found. There was very little free fat or fatty acid, practically no soap; no starch. Total nitrogen content 9.6 grams. Result practically normal.

Dr. Flint, in 1912, in the Johns Hopkins Hospital Bulletin, wrote upon the effect of extensive resection of the small intestine and reported considerable experimental work. He concluded that where 50 per cent. or more of the small intestine was resected, serious consequences usually followed. He emphasized the compensatory process which goes on after such operations.

Turck more recently, in 1914, reported a successful case with the removal of one-half of the small intestine and an end-to-end anastomosis. This seems to be one of the most recent contributions on the subject.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting, held March 6, 1916

The President, Dr. Charles H. Frazier, in the Chair

IMPROVED METHOD OF CLOSING WIDE CLEFT PALATE MALFORMATIONS

Dr. John B. Roberts presented an infant to show the result of an operation for closing a cleft palate. He said that cleft palate operations by Brophy's "tie-beam" sutures of the upper jaw had in his work in early infancy cases caused much undesirable suppuration within the mouth, or severe damage to the alveolus. Recently, therefore, he had adopted, as in the case shown, a method by which the wire sutures were introduced from the outside of the cheeks, and were carried through the two upper maxillary bones. The separated portions of the roof of the mouth, being still largely cartilaginous, are drawn closer together by twisting the two wires over corks covered with gauze on the outside of the cheek on each side. Later, these wires are twisted to increase the approximation of the sides of the cleft in the palate and maxillary bones. He had in the two cases buried the twisted ends of the wire beneath the skin, and allowed the cutaneous wounds to have a chance to close, though their union is slow on account of some suppuration. At the time the tie-beams are introduced the cleft in the alveolar process in front is closed by a wire suture, and at a later period the cleft in the lip united by silkworm-gut sutures. The first step in the operation had been done when the infant was about three weeks old, that step being the introduction of the tie-beams and wiring the alveolus. The second step is the closing of the lip at about four weeks and a half of age. The case presented shows the wires introduced and the lip still open. A second patient has had the wires in the jaw for four months with very little irritation, except some slight suppuration of the cheek wounds. The anterior part of the cleft in the roof of the mouth is closed, the alveolus has been brought together, and the upper lip, now united for several weeks, looks very well.

In future he intended to introduce the wires so as to have a twist on one side only, doing this by returning the end of the first wire across

the cleft a second time and having the loop on the second cheek buried at once. He was not sure but that, after taking out the wire tie-beams at the end of five or six months, he would introduce for a considerable period, either another set of wires, or perhaps be satisfied with a heavy kangaroo tendon loop and knot for the two supporting sutures.

He had for a number of years been convinced of the value of Brophy's suggestion to close these wide clefts in early infancy so far as is possible while the upper jawbones are largely cartilaginous. The impact of the mandible against the upper jaw has a tendency to keep the cleft from coming together and, perhaps, widens it. Therefore, early support and approximation of the two sides of the fissure by the prolonged use of tie-beam sutures, and by closure of the upper lip and the alveolus, seem mechanically wise. It seems cruel to make suppurating wounds on the outside of the cheeks of these little patients, but this is of less importance when one thinks of the gravity of the congenital malformation. The dimpled scars in the cheeks, left after healing of the wounds, may easily be made inconspicuous by plastic operation.

BONY UNION OF TRANSVERSE FRACTURE OF BOTH PATELLÆ WITHOUT OPERATIVE SUTURE

Dr. John B. Roberts presented a man aged perhaps 50 years, who last December, while in the Polyclinic Hospital for fractures of the fibula, called his attention to his knees. He stated that Dr. Roberts had treated the left patella with a board splint twenty-two years ago, April 3, 1894, at the Polyclinic, and the right patella for a similar fracture about six years previously with hooks at the Pennsylvania Hospital. On investigation it was found that the man had been in the Pennsylvania Hospital about 1886, when Dr. Roberts, as Out-patient Surgeon, was using the Levis separated Malgaigne's hooks for this fracture, having been taught their value by seeing Dr. R. J. Levis's success in getting close union by means of them. It is possible that his connection with the case at the time was as Dr. Levis's assistant, for he did not remember the patient clearly. The patient still shows evidence of scarring of the skin by the hook points; and the patella is solid, of good shape and the mobility and usefulness of the limb perfect. The left patella is a little larger than its fellow; a shallow transverse groove in it is palpable, and the outline of the periphery is a little distorted. The flexion of this knee is slightly restricted in extent. The man declares that they are both perfectly useful; and, as he is a laborer, this testimony as to absence of disability is worthy of acceptance. The skiagraph plate shows apparently a close, probably an osseous, union of both bones.

FIG. 1.—Condition before operation (about two weeks old).

FIG. 2.—Condition when about three weeks old.

FIG. 3.—Condition after first operation (about three weeks old).

At the Pennsylvania Hospital at the time mentioned, about 1880, Malgaigne's hooks were frequently employed during a number of years by T. G. Morton and R. J. Levis, and also by the reporter, following them, with great satisfaction. Since that time he had used adhesive straps to hold the fragments together, and applied a posterior splint of wood or of gypsum and gauze, as was the case in this man's second fracture. At other times he had used a circumferential subcutaneous suture in the coronal plane, or had exposed the bone by incision and sutured the periosteum and muscles. The last has been done as an exception. In all cases the rectus femoris muscle is kept relaxed by flexing the hip-joint during treatment.

He thought this case sufficiently interesting to present to the Academy because of the vigorous opposition of many to the employment of non-open treatment of this fracture. Two united and useful broken patellæ, one of twenty-two years' and the other of about twenty-eight years' standing, giving a laboring man no disability sufficient to attract his attention, are surely eloquent witnesses to the value of subcutaneous or non-operative treatment.

ABSCESS OF BRAIN

Dr. J. Stewart Rodman presented a woman, 30 years of age, who was brought to the Presbyterian Hospital in a dazed condition, having fallen shortly before, striking her head on a wash-tub. The following day, when her history was taken, she was fully conscious, and answered fairly well. The upper part of the left side of the face involving the forehead was swollen and ecchymotic. Fluctuation was obtained over left malar bone. No crepitus—no increased tenderness.

Eyes.—Right, normal. Left eyelid swollen and ecchymotic. Marked subconjunctival swelling. Pupil reacts sluggishly to light. No discharge from ears or nose. Thorax, abdomen and extremities negative; no paralysis; pulse regular, good volume—80.

Spinal puncture, day of admission; 10 c.c. fluid obtained under moderate pressure and slightly blood tinged.

X-ray showed fracture of left malar bone, and fracture (possible) of sphenoid.

During the following three weeks there was gradual absorption of the swelling over malar; irregular type of fever. Mentality good for two weeks, then drowsiness and beginning difficulty in speech, and weakness on right side. Appearance of swelling, giving fluctuation in left temporal region.

Examined by Dr. Cadwalader three weeks after admission.

Result of neurological examination, incomplete paralysis right side face, arm and leg. Reflexes exaggerated left side. No Babinski. Sensation uncertain because of mental condition. Understands what is said to her and recognizes objects. Cranial nerves react normally.

Diagnosis.—Depressed fracture of left temporal bone or hemorrhage without fracture. Possible encephalitis or cerebral abscess from infection travelling from sinuses.

An exploratory craniotomy was done by Dr. Rodman. Vertical incision through the centre of the left temporal swelling. A large collection of pus under scalp was evacuated. A fracture of the left temporal bone was exposed. The fracture opening in skull enlarged by a rongeur and the bulging and tense dura was opened by a criss-cross incision. The brain cortex bulged into wound. Convolutions flattened out. Exploratory puncture: Reached greenish pus about 2½ to 3 cm. below surface of cortex. Incision then made into cortex and about 2 oz. of greenish pus evacuated. Rubber tissue drain to abscess cavity. Scalp incision closed with interrupted silkworm gut.

Postoperative Course.—Temperature remained normal. Could talk following day with some hesitancy; afterwards speech normal. Sixth day following operation, slight convulsion lasting few moments; twitching of face and both hands; pupils dilated; inability to speak; pulse weak; lasted only a few minutes. On the tenth day following operation, slight twitching of facial muscles; lasted ten minutes; fully conscious. After this, recovery entirely uneventful. Original drain undisturbed for three weeks. At that time drainage ceased and drain removed.

Culture of pus from abscess of brain staphylococcus albus.

SARCOMA OF LEFT HUMERUS AND FEMUR

Dr. Rodman presented a woman forty-nine years of age. Had suffered from pain in her left shoulder for three years. Two years ago first noticed a swelling of this shoulder. She thinks swelling is now little if any larger than when first noticed. During this past summer, July, 1915, a swelling developed gradually above her left knee. She tripped and fell in July, 1915. Following this her knee became swollen, but in about a week she was able to get about with the help of a cane and crutch. Fell again one week prior to admission, striking her shoulder and thigh. After this fall, both shoulder and thigh painful. When admitted, she was rather emaciated; her left shoulder was symmetrically enlarged and pulsated. A loud bruit could be heard over the swelling. Systolic murmur heard in left supraclavicular triangle and

also in left suprascapular region. Little, if any, limitation of motion in left shoulder-joint, but some muscular weakness. Just above and including the left knee the diameter of the part was increased by one-half by a symmetrical swelling. Not tender; no apparent pulsation, but a loud systolic murmur heard over entire swollen area. Unable to bear weight on the left leg because of pain. No crepitus nor preternatural mobility.

Diagnosis.—Osteo-angio sarcoma of left humerus (primary) and left femur (secondary).

RICHTER'S HERNIA. ACUTE INTESTINAL OBSTRUCTION

Dr. Rodman presented a third patient, a woman, sixty-eight years of age, who, until two days prior to admission, had been enjoying her usual good health. She then developed sudden severe lower abdominal pain, cramp-like in character. Vomited frequently during the day of onset and also during the following day. Pain also continued. Was given purgatives but was unable to have a bowel movement. Abdomen became distended.

Two hours after her admission to hospital Dr. Rodman made a midline incision between symphysis and umbilicus. On opening the peritoneum, free fluid escaped, and distended coils of small intestine crowded into the wound. On pushing these aside, collapsed small intestine was found which was traced to the left internal ring. There bowel had become caught by a prolapse of one wall into the opening (Richter's hernia). Gentle traction was sufficient to disengage the bowel. The dark area where that bowel had been caught (one wall) was infolded by interrupted Lembert stitches of Pagenstecher. Wound closed without drainage. Recovery uneventful.

HANDLING OF CHILDREN WITH TUBERCULOSIS OF THE SPINE WHILE THEY ARE UNDER THE INLUENCE OF AN ANÆSTHETIC

Dr. Walter G. Elmer read a paper with the above title, for which see page 34.

ELEMENT OF ERROR IN ABDOMINAL DIAGNOSIS

Dr. Harold L. Foss read a paper with the above title, for which see page 39.

Dr. John H. Gibbon said that anyone who looks upon abdominal diagnosis from a fair point of view, must agree that the surgeon who makes no mistakes is either more or less than a man. Mistakes are

made not often because we do not know the difference between two conditions, but because we do not devote enough time to the study of the case. It is fortunate in many ways that surgeons forget their mistakes, yet it would be a good thing if we had them constantly before us. The speaker presented before this Academy some time since a paper on perforated duodenal and gastric ulcers. Yet within a year he operated upon a case in which he was satisfied with the removal of an appendix that was acutely inflamed and covered with lymph. The man died and an autopsy showed a perforated duodenal ulcer! Surgical judgment and common sense are also absolutely necessary in order to avoid mistakes in surgery. The less a man knows about a thing, often the more confident he is. The man who is overconfident does not recognize his mistakes. Self-satisfaction, carelessness and haste are bad things in surgery. Out of dissatisfaction with one's self will come improvement. That a patient may pass through many hands without a correct diagnosis of his condition being made was illustrated ten days ago in the case of a man who for fifteen years had had attacks of severe pain in the upper abdomen. He had become a "neuro," of course, in that time. One man had passed him on to another, each recommending his favorite treatment; meanwhile the man's neurasthenic symptoms had become very pronounced. He finally fell into the hands of a bright woman physician, who suggested having an X-ray picture taken, and 17 gallstones could be seen in the plate, and were promptly removed. In operating for appendicitis the surgeon has to keep in mind that, even if he is right in his diagnosis of chronic or subacute appendicitis, there may be something else present. The first three or four cases of ureteral stone the speaker operated upon had been diagnosed appendicitis and in two of them the appendix had been removed.

Dr. John H. Jopson said that it is undoubtedly true that many errors in diagnosis in abdominal lesions, as elsewhere, are attributable to haste and carelessness; and, it may be added, sometimes to mental and physical fatigue. Pirogoff emphasized this many years ago in connection with his report of a femoral aneurism which he had opened in mistake for an abscess. It will also seem that the distance between the brilliant diagnostician and the conscientious plodder is being greatly lessened by the general adoption of exact laboratory methods, and especially by the use of the X-ray. It is equally true that the question of judgment in the interpretation of laboratory as well as clinical data, skill in physical diagnosis by personal methods of examination, and the personal equation generally, will never be eliminated by any methods of research.

Regarding gastric and duodenal ulcer, he gathered from Dr. Foss's statistics that in ten cases of his series a diagnosis of ulcer had been mistakenly made where other lesions were proved present at operation. Only three times had ulcer been found when some other pre-operative diagnosis had been arrived at. This bears out his own conviction as to the chances of an obscure lesion being ulcer or something else. When the differential diagnosis between ulcer, gall-stones and appendicitis is puzzling in the absence of certain confirmatory symptoms, the chances are several to one against ulcer being present.

In connection with the diagnosis of gall-stones, he had been much interested in the papers of Cole, who points out that 20 per cent. can be detected with comparative ease by the use of the X-ray, due to the presence in the stones of the calcium salts. In the remaining 80 per cent. the greater density of the bile itself to the X-ray renders it necessary to demonstrate the negative shadow of the stones and the so-called "bunch of grapes" appearance which they present. After much experimentation with gall-bladders removed from the body, immersed in water and bile, Cole arrived at a technic which he thinks fairly reliable, and in fifteen cases in which he made the diagnosis of gall-stones in cases referred to him for the purpose of diagnosis, in twelve his opinion was proven correct when the patient came to operation. It would, however, be interesting to know in how many cases, in which he failed to make the diagnosis, gall-stones were afterward shown to be present.

As regards the percentage of errors, the speaker had been interested in hastily looking over fifty consecutive histories of his own private cases of abdominal operations to determine how many gross blunders in diagnosis he had made. There were six cases in which such an error in diagnosis was demonstrated, or 12 per cent. These errors included a case of acute hæmatosalpinx in early unruptured extra-uterine pregnancy, diagnosed acute appendicitis; appendicitis and general peritonitis diagnosed probable nephritis with complete suppression of urine and abdominal symptoms; a case diagnosed perinephritis, in which nothing definite was found, but the patient improved after appendectomy; a case diagnosed subphrenic abscess, which recovered, no abscess being found; sarcoma of the transverse colon, with perforation and circumscribing adhesions, diagnosed gall-bladder disease; sarcoma of the stomach, diagnosed as ulcer and hour-glass stomach. In the last case there were three separate nodes of sarcomatous tissue in the stomach wall, with irregular contraction of the same between them, producing an X-ray appearance simulating hour-glass stomach.

FRACTURE OF THE FEMUR

Dr. W. L. Estes, of St. Luke's Hospital, South Bethlehem, Pa., read a paper with the above title, for which see page 74.

Dr. George P. Müller said that most of the mistakes one sees in consultation practice are due to the neglect or inability to use the X-ray. Dr. Estes has accurately formulated the indications for operation. In oblique fractures of the femur it is practically impossible to effect satisfactory reduction. Dr. Martin has stated that where a fracture can be reduced and held, there is no necessity of doing anything further, but if it is not held then means should be taken to this end. It is at this point that the speaker became radical in his opinion. There is no use waiting week after week, and trying method after method to reduce and hold a fracture of the femur, humerus, or tibia. At the end of this time there is hopeless shortening with the prospect of a dangerous operation; whereas, if the irreducibility is recognized at the end of the first week, an operation will correct the deformity or displacement, can be easily done, and will give practically perfect results.

Dr. Estes spoke of the bowing of the femur, and he had tried to take advantage of this by proper support during the application of the plate. Dr. Roberts has stated that the ideal method of the future will be the use of some absorbable fixation material which will hold the fragments accurately together, and he mentions the use of fascia and of catgut. Such fixation material is, however, too weak to stand the strain of the force exerted by the leverage action of a long bone. No one has introduced a method superior to the steel plates now in use. He did not believe in the common statements that the plate, *per se*, prevents callus formation, nor that the screws induce necrosis or softening of the ends of the fragments. He had made some very interesting observations upon a small series of cases, carefully studied, which show that it is not the plate but the absolute fixation that prevents callus. As to necrosis, this complication is due to infection and not to the presence of the screws.

Dr. John B. Roberts discussed the third and fifth propositions of Dr. Estes's paper. The former raises the question of the importance of general management of fractures of the femur; the latter discusses results, period of disability and the relative value of the bloodless (non-operative) and the blood-letting (operative) methods of treatment.

Dr. Roberts said that he had a firm conviction that the serious nature of the mechanico-physiologic problems presented by a broken thigh bone is not realized by those surgeons who leave this portion of the treatment to the discretion of an inexperienced hospital interne,

a nurse, or a hospital orderly. It is largely this negligent attitude of hospital surgeons which has made statistics when collected from many sources so discouraging. These statistics have driven a considerable proportion of surgeons to adopt incision, with direct fixation by means of metal plates, as a routine treatment. The same type of fracture treated by non-operative means in private practice is followed by better cure, because the responsibility is more direct, the pecuniary reward greater, and censorious criticism more likely. The recently enacted Workingman's Compensation Law in Pennsylvania will indubitably improve statistics by fixing the attention of hospital surgeons on this item of fracture treatment.

Dr. Estes's fifth proposition is concerned with the disability after fracture of the femur, and the relative value, as to functional cure, of the non-operative and the operative or open methods of treatment. It comprises, indeed, the most important topic of his admirable address. This phase of the discussion was of supreme interest to him for the reason that of late years he had been compelled to take a stand which would seem to show that his opinion as to fracture treatment had changed on the question of operation. Years ago he was an advocate of the profession operating by incision upon fractures, although few men operated for this lesion of bones. Now, however, he was constantly declaiming against the frequent use in surgery of fixation of fractures of bones of the extremities with metal plates. The fact is that his opinion has differed very little from that which governed his practice in the earlier years mentioned, except that he operates now rather more frequently than he formerly did. The trend of events, or what he might call a curious herd-like or gregarious change of opinion, has caused many practitioners of medicine and surgery to rush into operative treatment of all kinds because of a mistaken view of the part which nature plays in the cure of many medical, and a considerable number of surgical, lesions. The human mind is apt to be so swayed by the shifting winds of popular thought on the one hand, or set like gypsum, by routine and non-appreciation of psychic movements on the other hand, that many cease to grow mentally, or have our mental development actually choked as the vines of a jungle destroy young growing trees. We cease to think in terms of logic, and are either controlled by a stony conservatism, or follow the lead of some great operator with a tarantella-like childishness. Personally, he believed that the furore for operative treatment of fracture of the femur and other long bones is about to lessen, and that within the next decade fewer fractures of long bones, rather than more, will be subjected to

operative attack as a routine of treatment. Scarcely more than 15 or 20 per cent. of closed fractures of long bones need be treated by operative incision for reduction and fixation. The bloodless or subcutaneous treatment is sufficient in skilled hands, with careful general treatment and frequent observation, for about 80 or 85 per cent. of broken bones of the extremities. The essentials on the part of the surgeon are that he, when undertaking to treat a fracture, look at a bare bone, remember the muscular attachments in the neighborhood, compare the limb with the normal limb on the opposite side, give an anæsthetic to determine the presence or absence of fracture, and the probable line of break if one exists, reduce the fragments so that the injured limb looks like the normal one, steady the bones with contour splints or gypsum gauze with or without traction as the case may be, examine the position every day for the first week, and at less frequent intervals later, and use light massage and careful mobilization of joints from the beginning to the end of treatment. A great aid to anæsthesia is the use of the X-ray to prove the existence of fracture and to check up the results of his anatomical examination under ether. Too much reliance, however, must not be put upon this method of examination. The surgeon must have some knowledge of X-ray appearance of bones, and will need to connote his knowledge of anatomy with the radiologist's knowledge of shadow pictures. It is probable that a practitioner with a good knowledge of bare bones and their muscular attachments, and with the mechanical instinct of the carpenter and plasterer, will do better without radiography than a radiographer without a knowledge of the practical side of surgery. The man who has the knowledge of the X-ray expert to help him, will, however, be often benefited. The greatest defects in hospital treatment of fractures of the femur are the sagging spring-mattress on the bed, an ignorant orderly with a douche-pan instead of a bed-pan, and a careless attention to steady traction. The drumhead canvas bed-frame adjustable to the ordinary fracture bed, so as to give counter-traction, used by Dr. E. A. Bryant, of California, is a cheap way of solving some of these difficulties (see Fig. 4). In operations for the exposure and treatment of deformed fractures of the femur, with long-standing contraction of muscles, he knew of no better way for continuing strong traction during application of the metal plate, after the malunion has been cut apart, than the Levis thigh plate and compound pulley (Fig. 5). This gives an easy method for maintaining the extension during the application of the necessary fixation by metal plates.

There is a great need for some form of absorbable mechanical

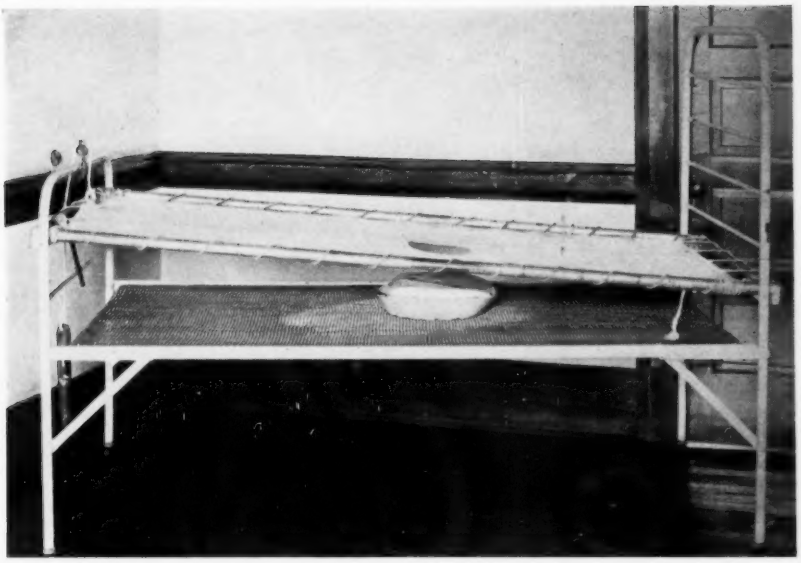

FIG. 4.—Drum-tight canvas and gas-pipe frame used by Dr. E. A. Bryant of Los Angeles, Cal., for reducing countertraction in fractures of the femur. Notice how it is hooked upon the braces of the head and foot pieces of the ordinary metal bed and thus obtains counterextension by the weight of the patient's body. Beneath it on the spring mattress of the bed may be placed any sort of a receptacle for fæces, since the canvas has an opening through which defecation may take place. The Buck's traction apparatus is attached to the limb of the patient by adhesive plaster and a stirrup, in the usual way.

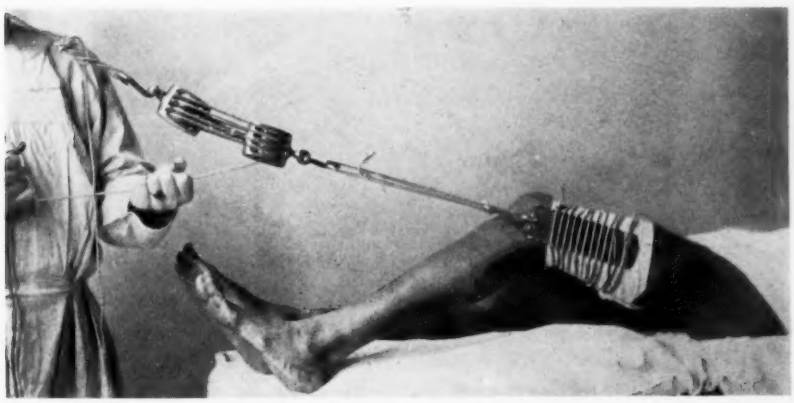

FIG. 5.—Method of reducing overlapping fragments of a fractured femur, when operating for fixation by plate and screws. The Levis traction plate and a set of compound pulleys make the reduction easy.

support applied directly to the broken bone that will give fixation and prevent overlapping as does the metal plate with screws. The osteogenetic inlay of Albee will often be found valuable, particularly in malunited and ununited fractures. He had suggested some variations in shape and material of plates, such as using aluminum instead of steel; and he had applied an artificial periosteum made of a graft or transplant of fascia lata taken from the opposite thigh for maintaining a fracture in reduction. It should be borne in mind that the fixation appliance is to prevent overlapping and rotary or lateral or anteroposterior displacement, rather than to give perfect rigidity. Hardly anyone depends upon the plate to give rigidity, but for that purpose uses the gypsum encasement or some form of rigid external support in addition to the fixation plate. Traction is usually employed after operation to prevent recurrence of overriding in femoral fracture. Another misconception of the problem is a too rigid belief in the value of measuring with tape measure or other standard unit. The shortening of a man's leg may be in the femur, or in the tibia, or in both. If the patient is placed squarely on his back, with legs extended and the line connecting the anterior spinous processes of the two ilia at right angles with the long axis of the body, the surgeon's eyes may readily see whether or not undesirable shortening exists in the femur by comparing the relative positions of the two patellæ. This is as easy as telling whether a large picture hanging on his office wall is horizontal, and throws out of account a possible difference in length of limb due to asymmetry of the tibias.

The surgeon should not forget in reconstructing a femur that the normal femur of muscular individuals is arched forward. This is seen when the shaft is viewed laterally. He was one of those who believe that it is hardly necessary for a man to carry a large amount of steel buried in the muscles of his leg after the bone has united. He saw, therefore, no particular reason against cutting down and taking a steel plate out of a man's thigh after union has been secured. This must be done, of course, with an aseptic technic, and is more necessary in those whose occupation takes them away from surgical observation than in those whose business and residence permit them to have surgical aid at hand in the event of future trouble from the buried metal splint.

Dr. A. P. C. Ashhurst regretted that Dr. Estes did not have time to go more fully into the question of fractures of the neck of the femur, a subject which often is overshadowed in interest by fractures of the shaft. In fracture of the neck more emphasis should be placed upon keeping the patients in bed until union occurs; but remaining in bed is

not alone sufficient to secure union. The primary impaction, which results from the accident, often is slight, and if no efficient treatment is instituted these patients will recover, or rather fail to recover, with non-union. In primarily unimpacted fractures Cotton, of Boston, has undertaken to hammer on the trochanter with a wooden mallet until he produces artificial impaction; his reported end-results so far are few, but encouraging. But the idea of a hammer is not very attractive, and for the last five years he had been practising Cotton's artificial impaction in what seemed to him an equally efficient but less theatrical manner: he had found it sufficient to anæsthetize the patients, reduce the fracture in the ordinary way, and then simply abduct the limb until one hears the bones crunch, when the fragments will stay together; they are then held in this position by a gypsum dressing. Now the question arises, what patients will stand all this? His first patient was a lad of fourteen years; he secured an anatomically and functionally perfect result, except for 0.5 cm. shortening, and moderate loss of abduction, which inconveniences him not at all except in gymnastic exercises. Any reasonably healthy patient up to sixty years, perhaps older, will stand this method. Even in the case of impacted fractures with deformity, in such patients, the position of the fragments should be improved by this method.

Next, in the case of patients who cannot endure such radical treatment, the surgeon should not wash his hands of all responsibility for securing a useful limb. If they are abandoned to themselves non-union is inevitable. For these cases no method is so satisfactory as that of Phillips, Maxwell and Ruth. Under this treatment, which can be instituted in every case, no matter how feeble the patient, a certain proportion of fractures, even when entirely intracapsular, will result in union without impaction, *provided one first reduces the fracture.* Attention must be given to flex the hip up to about a right angle, make vertical extension upward, and finally bring the limb down in abduction and inversion; then apply the Phillips dressing, with an apparatus like Volkmann's sliding splint, to prevent outward rotation of the limb.

Old fractures at the hip, with non-union, usually are the result of inefficient treatment when the fracture was recent, as has been repeatedly pointed out here by Dr. G. G. Davis. Such patients deserve to be treated more energetically than heretofore. Many of them are otherwise sound physically. Two operative procedures are open to us: one for patients who will endure long fixation, the other for those who will not. (1) The speaker had done three bone-peg operations for non-union: the first patient was a man of 30 years, and is the only one

with an entirely satisfactory result. He has some shortening and a little limp, but with good solid union was able to return to his work less than a year after operation. The second patient was 42 years old, and though he seems to have solid union, without much shortening, he seems to have no intention of returning to work so long as he can find someone to support him. The third patient, aged 52 years, returned to work (cigarmaker) about six months after operation, and though he uses a crutch on the street, requires no support walking about the house. (2) In patients incapacitated by non-union of neck fractures there is another method of treatment suitable for those who cannot endure long confinement to bed after operation. This is simple excision of the head fragment, as advocated by Lambotte. The patients can then be gotten out of bed in ten days or two weeks, and though walking with a limp, and perhaps requiring a crutch, are said to be markedly relieved of their pain and disability.

Finally, in regard to fractures of the shaft, he inquired of Dr. Estes whether he thought the condition of the soft parts (in simple fractures with much swelling) is improved by early operation, say on the first to third day, or whether it is better to wait until the swelling has subsided of itself, which may be in such cases as late as the fifteenth day. Lambotte claims for the operative treatment of recent fractures, when once the form of the bone has been restored by an absolutely rigid support applied directly to the shaft, that it enables the surgeon to disregard the bone and to take care of the soft parts as if no fracture had existed. He goes so far as to say that he believes that when a femur has been properly plated, it would be possible for the patient to walk on it the next day; but he adds that it is not expedient to make the experiment. This theory (that rigid fixation of the bone enables one to eliminate a fracture as a factor in the subsequent treatment and to pay proper attention to the soft parts) is seductive, but in practice it cannot always be carried out; and in most fracture operations, especially those involving the femur, external retentive apparatus is required, and in difficult femur cases he had seen Lambotte himself apply plaster-of-Paris dressings. Yet he believed that when a plate tears out it is the fault not of the plate but of the surgeon, who did not put it on correctly. In most such cases one or two screws have been used, where there should have been six or eight; or else the plate has not been placed across the obliquity of the fracture, so as to bring the pull of the fragments in a plane at right angles to that in which the screws are inserted. In cases where the fragments are difficult to retain, there need be no limit to the amount of internal fixation appliances employed; several

plates may be used, or the plates and fragments both may be encircled with wire. So long as rigid fixation is secured, so long as the metal is sufficiently covered by the soft parts, and so long as no infection occurs, there is very little likelihood of the plates subsequently requiring removal. Of course a plate *may* work its way out years later. Dr. Edward Martin had told him of a patient who came to him seventeen years after Dr. John Ashhurst had inserted a plate in his leg; only after that long interval did it begin to cause trouble. But even if a plate may remain quiescent for so many years and then begin to work its way out, one does not have to abandon the use of plates on that account. They are in my opinion the most reliable means of fixation for recent shaft fractures.

DR. ESTES in closing, said that the Steinmann nail is being used much abroad at present in the cases of terrible shattering of limbs, and with excellent results. This frequent use is because of its easy application.

In treatment of fractures of the neck of the femur the most satisfactory treatment is by the old Hodgen splint. By this method any degree of abduction desired can be secured. It also carries out the idea of Murphy, by bringing the two fragments of the bone together. He agreed with Dr. Roberts in what he has said concerning the open operation. But the men who treat fractures most, who have the largest clientèle of fracture practice, are doing the open operation more and more. It seemed to him that the revelations of the X-ray have rather disturbed former belief in our excellent results. His paper stated that there was always danger of infection in the open operation and that always should one attempt reduction by the closed conservative procedure before attempting the open method. After proper reduction, proven by skiagram, there is no reason for doing the open operation, provided one can hold the fragments by some apparatus.

The fascia fixation mentioned by Dr. Roberts is excellent in some bones, but is not sufficiently rigid in the large bones.

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